253

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3924 MEADE ST.
DENVER, COLORADO

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PHOTOFACT* Folder

*TRADE MARK

RETMA MEMBER RADIO-ELECTRONICS-TELEVISION MANUFACTURERS ASSOCIATION

HALLICRAFTERS
MODELS 17T310B, M, W (Ch. A1600D)

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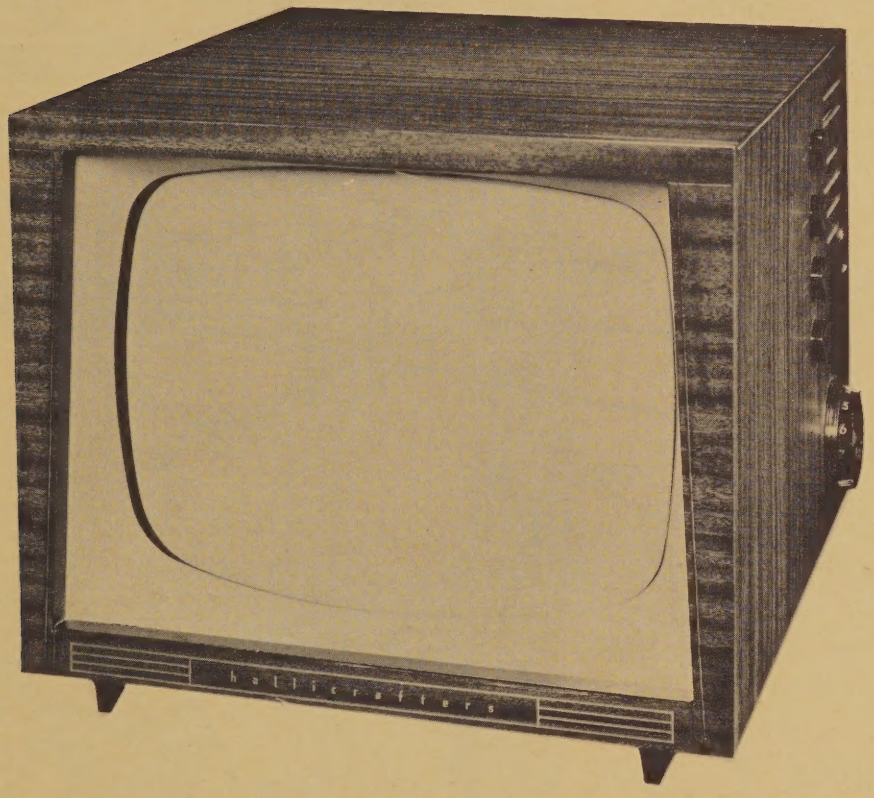

MODEL 17T310M

HALLICRAFTERS
MODELS 17T310B, M, W (Ch. A1600D)

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DATE 10–54 SET 253 FOLDER 7

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MODELS 17T310B, M, W (Ch. A1600D)

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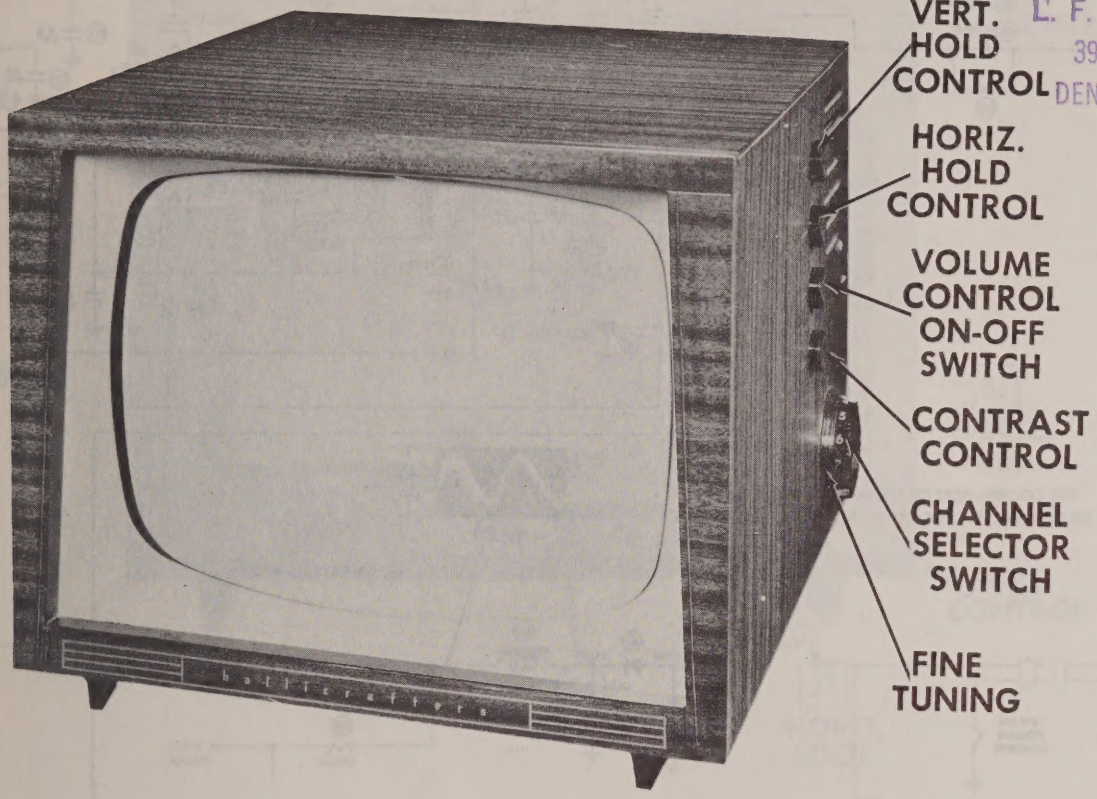

HALLICRAFTERS MODEL 17T310M

TRADE NAME	Hallicrafters Models 17T310B, 17T310M, 17T310W (Ch. A1600D)
MANUFACTURER	Hallicrafters Co., 4401 W. 5th Ave., Chicago 24, Ill.
TYPE SET	Television Receiver
TUBES	Fifteen
POWER SUPPLY	110-120 Volts AC-60 cycle RATING 1.14 Amp. @ 117 Volts AC
TUNING RANGE—	Channels 2 thru 13, Video IF 26.4MC, Sound IF 21.9MC (Intercarrier)

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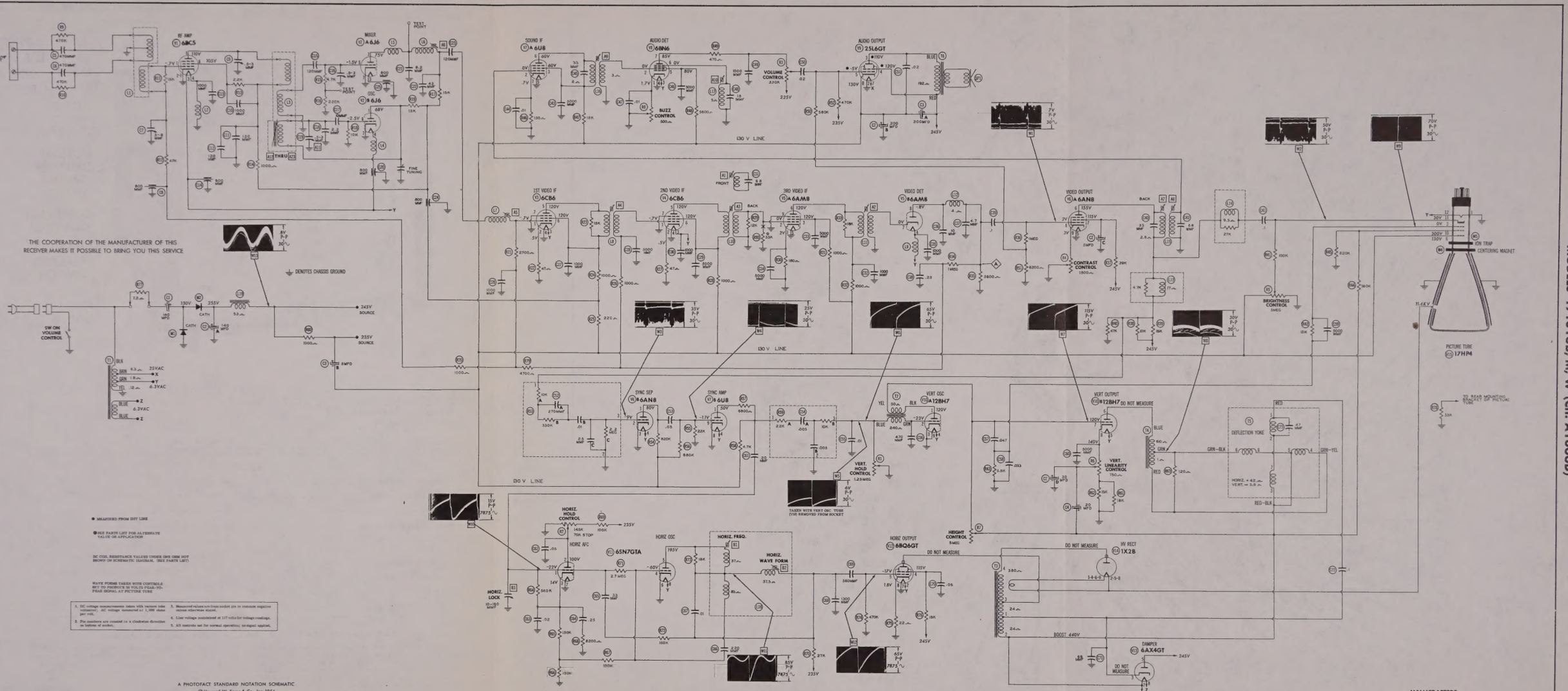
MODELS 17T310B, M, W (Ch. A1600D)


HALLICRAFTERS
MODELS 17T310B, M, W (Ch. A1600D)
THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE
DENOTES CHASSIS GROUND
SW ON VOLUME CONTROL
245V SOURCE
235V SOURCE
RF AMP V1 6BC5
MIXER V2 A 6J6
OSC V2 B 6J6
TEST POINT
A1 THRU A10
FINE TUNING
TO VHF ANT
SOUND IF V17 A 6U8
AUDIO DET V18 6BN6
AUDIO OUTPUT V19 2 5L6GT
VOLUME CONTROL 220K
BUZZ CONTROL 500Ω
130 V LINE
1ST VIDEO IF V3 6CB6
2ND VIDEO IF V4 6CB6
3RD VIDEO IF V5 A 6AM8
VIDEO DET V12 6AM8
VIDEO OUTPUT V6 A 6AM8
CONTRAST CONTROL 1500Ω
BRIGHTNESS CONTROL 2MEG
ION TRAP
CENTERING MAGNET
PICTURE TUBE V20 17HP4
11.4KV
SYNC SEP V8 6AN8
SYNC AMP V9 6U8
VERT OSC V10 A 12BH7
VERT. HOLD CONTROL 1.25 MEG
VERT OUTPUT V10 B 12BH7 DO NOT MEASURE
VERT. LINEARITY CONTROL 750Ω
DEFLECTION YOKE
HORIZ. HOLD CONTROL 145K 70K STOP
HORIZ AFC
HORIZ OSC V11 6SN7GTA
HORIZ. FREQ.
HORIZ. WAVE FORM
HORIZ. LOCK
HORIZ OUTPUT V12 6BQ6GT
DO NOT MEASURE
HEIGHT CONTROL 5 MEG
HV RECT V18 1X2B
BOOST 440V
DAMPER V13 6AX4GT
TAKEN WITH VERT OSC TUBE (V10) REMOVED FROM SOCKET
TO REAR MOUNTING BRACKET OF PICTURE TUBE
● MEASURED FROM 130V LINE
● SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION
DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM. (SEE PARTS LIST)
WAVE FORMS TAKEN WITH CONTROLS SET TO PRODUCE 55 VOLTS PEAK-TO-PEAK SIGNAL AT PICTURE TUBE
1. DC voltage measurements taken with vacuum tube voltmeter; AC voltage measured at 1,000 ohms per volt.
2. Pin numbers are counted in a clockwise direction as bottom of socket.
3. Measured values are from socket pin to common negative unless otherwise stated.
4. Line voltage maintained at 117 volts for voltage readings.
5. All controls set for normal operation; no signal applied.
A PHOTOFACT STANDARD NOTATION SCHEMATIC
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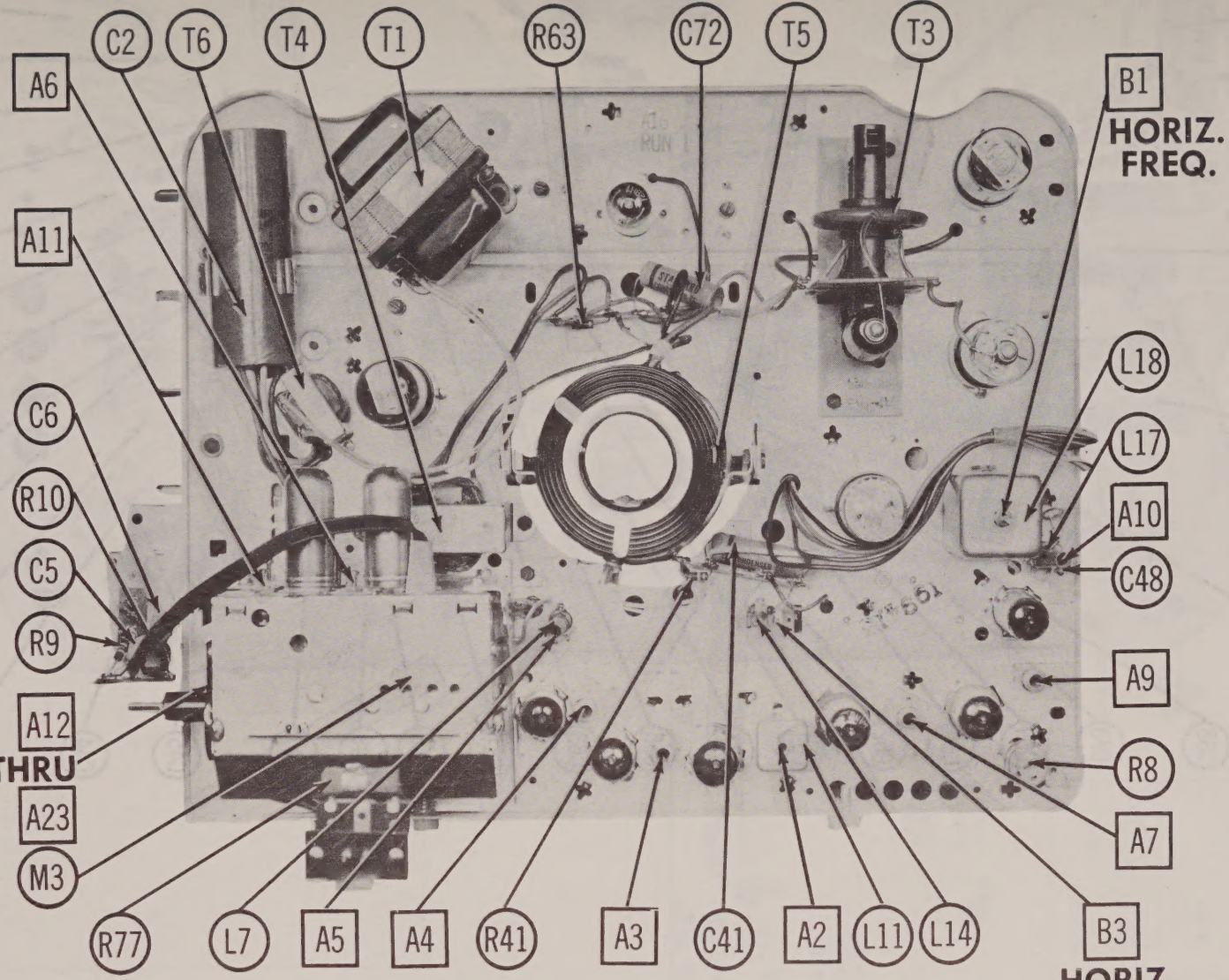
MODELS 17T310B, M, W (Ch. A1600D)



CHASSIS TOP VIEW

MODELS 17T310B, M, W (Ch. A1600D)
HALLICRAFTERS

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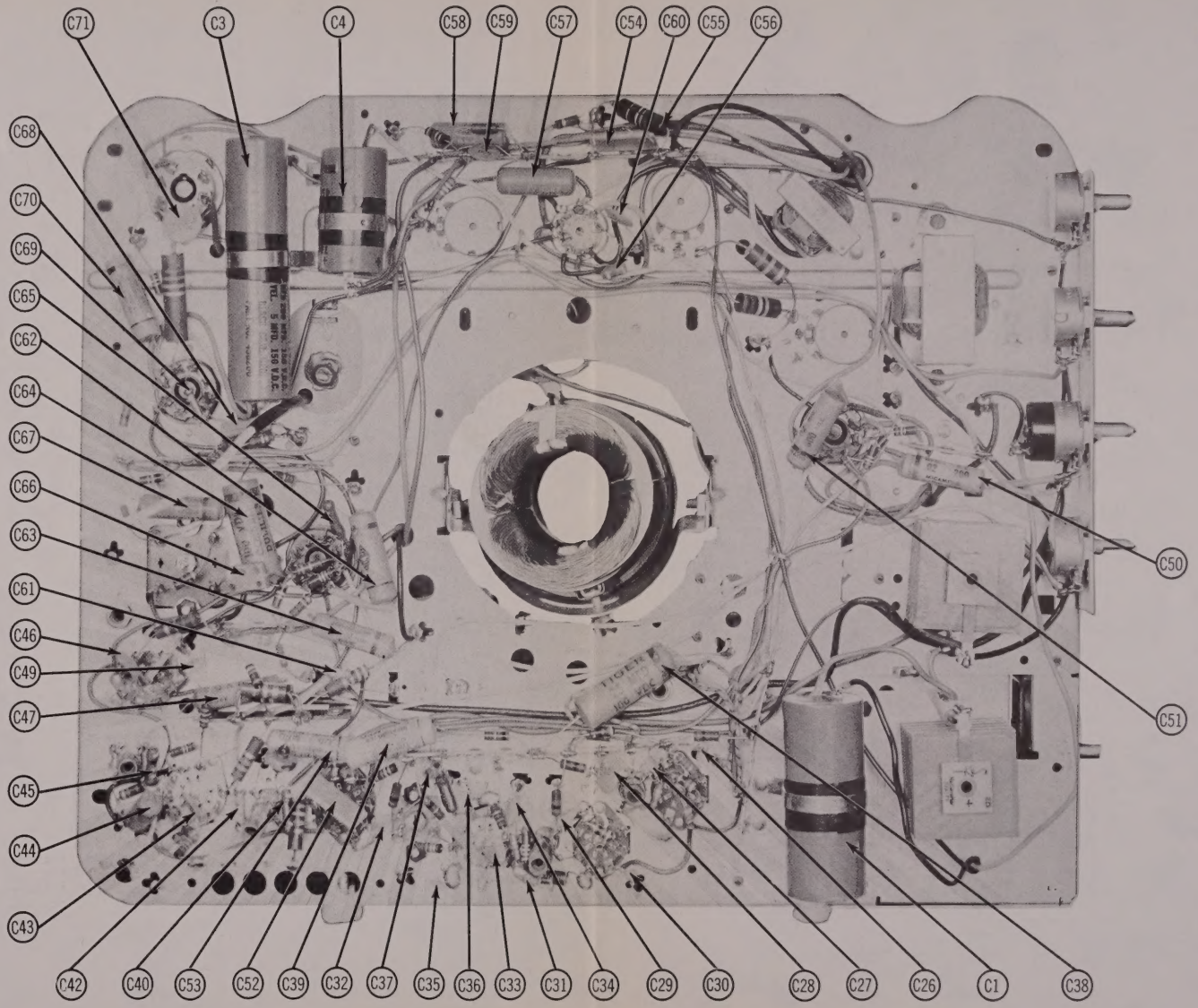

CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

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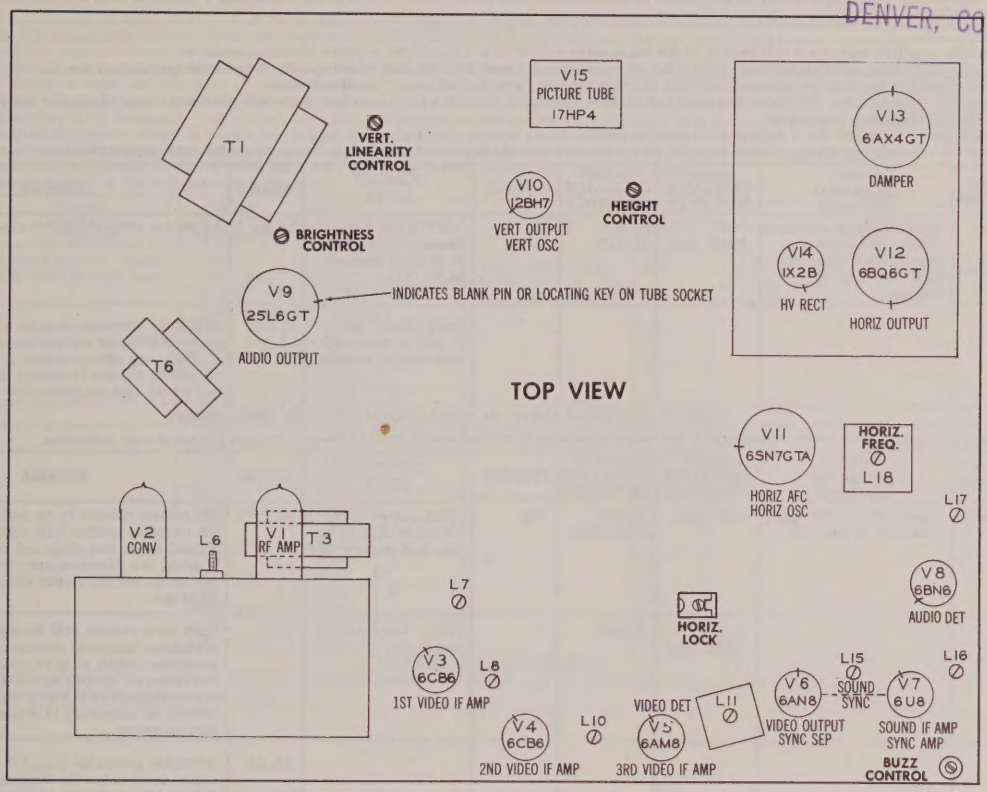
TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - Selenium Rectifiers (M1 & M2)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster -V2, V3, V4, V5, V9
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V6, V15
Has pic, no sound - V7, V8, V9

SYNC FAILURE
No vert. sync - V7, V10
No horiz. sync - V7, V11
No vert. or horiz. sync - V6, V7

SWEEP FAILURE
No raster, has sound -V11, V12, V13, V14, V15
No vertical deflection - V10
Poor vert. linearity or foldover - V10
Poor horiz. linearity or foldover - V11, V12, V13
Narrow picture - V11, V12, V13, V14, M1, M2
Vert. off freq. - V7, V10
Horiz. off freq. - V7, V11

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Use an isolation transformer to protect the test equipment.
The high voltage shock hazard may be eliminated by removing the 6AX4 (V13) from its socket and connecting a 2250Ω/30 watt resistor from pin 3 to pin 5 of the tube socket.

VIDEO IF ALIGNMENT

Connect the negative lead of a 3 volt battery to the ungrounded side of C38. Connect the positive lead to chassis.
Two peaks may occur during alignment of the video IF coils. Use the peak with the slug entering the coil from the end nearest the chassis. The sound trap (A1) should be tuned to the peak with the slug entering the coil from the end away from the chassis.
Remove the converter tube (V2) from its socket and replace with a 6J6 which has pin 1 removed. This will disable the local oscillator and reduce the possibility of erroneous indications.
Attenuate generator output for 2 volts peak to peak on scope.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	Direct	High side to an ungrounded tube shield floating over dummy converter tube. Low side to chassis.	24MC (10MC Swp)	21.9MC 26.4MC	Any	Vert. Amp. thru detector probe (Fig. 5) to pin 5 plate of 6CB6 (V3).	A5, A6	Adjust for response curve similar to Fig. 1.
2.	"	"	"	"	"	Vert. Amp. thru 3.3KΩ to point (A). Low side to chassis.	A1, A2, A3, A4	Adjust for response similar to Fig. 2. Adjust A1 for MINIMUM marker amplitude at 21.9MC . A2 affects center of response. A3 affects the low frequency end of response and A4 the high frequency end.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
3.	.001MFD	High side to point (A). Low side to chassis.	Not used	4.5MC (400% Mod)	Any	Vert. Amp. thru detector (Fig. 3) to pin 11 of picture tube.	A7	Set volume control to its mid-range position. Set contrast control fully clockwise. Preset A7 and A8 so that slugs are out of coil winding in a direction away from chassis. Adjust A7 for MINIMUM 400% indication on scope.
4.	"	"	4.5MC (15KC Swp)	4.5MC	"	Vert. Amp. across voice coil	A10	Turn buzz control (R8) 90 degrees from its maximum clockwise position. Attenuate generator output to give minimum useful indication on scope. Adjust A10 for maximum response at 4.5MC. Adjust volume control as necessary to maintain pattern size on scope.
5.	"	"	"	"	"	"	A8, A9	Attenuate generator output to maintain a signal level below the limiting action of the 6BN6. Adjust A8 and A9 for maximum response at 4.5MC.
6.	"	"	Not used	4.5MC (400% Mod)	"	"	R8	Adjust buzz control (R8) for MINIMUM 400% indication on scope.
7.	"	"	4.5MC (15KC Swp)	4.5MC	"	"	A10	Set generator to give a strong signal and adjust A10 for maximum response at 4.5MC. Attenuate generator output for signal input below limiting level of 6BN6 and repeat step 5.

SOUND IF ALIGNMENT USING A TV SIGNAL

Remove the dummy converter tube and replace the original 6J6 in its socket. Remove the 2250Ω resistor from pin 3 to pin 5 of V13 and replace the 6AX4 in its socket.
Tune the receiver to a TV station and connect an attenuator between the receiver and antenna so that the signal input to the receiver can be varied from weak to strong. If a suitable attenuator is not available stray feed the signal into the receiver by placing the antenna near the antenna terminals.
Set the buzz control (R8) to its approximate mid-range position.
Adjust A7, A8 and A9 for maximum program sound. If peaks appear at two differnet settings use the one at the farthest counter clockwise position.
Reduce signal input to lowest useable level and check settings of A7, A8 and A9.
Apply a strong signal and adjust A10 for maximum program sound.
Apply a very weak signal and adjust R8 for minimum noise.

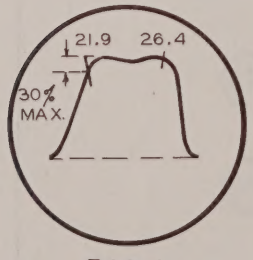


FIG. 1

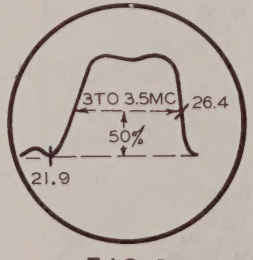


FIG. 2

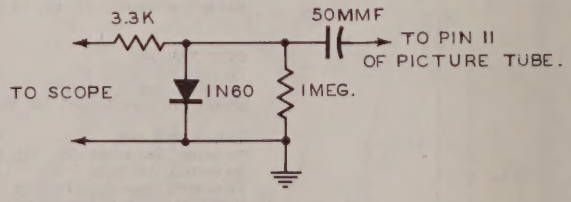


FIG. 3

ALIGNMENT INSTRUCTIONS (cont)

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3[illegible] MAINE ST.

OSCILLATOR ALIGNMENT

Leave the bias connected as under video IF alignment. Remove the dummy converter tube and replace the original 6J6 in its socket. Remove the 2850Ω resistor from V13 tube socket (Pin 3 to Pin 5) and replace the 6AX4 in its socket.
Complete oscillator alignment may not be necessary.
If the oscillator seems to be off frequency approximately the same amount for a majority of the channels it may be possible to correct them in one step using A11. It should be noted that this is an all channel oscillator circuit adjustment and should not be used to correct any individual channel. If adjustment of A11 will not bring all channels well within the range of the fine tuning control it will be necessary to adjust the channel strip adjustment for each channel that is off frequency. The channel oscillator adjustment screws are reached through a hole just to the right of the channel switch shaft. The correct adjustment screw is accessible through this hole as the channel switch is turned to each channel.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
8.	Two 120Ω Carbon Resistors	Across antenna leads with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 3.3KΩ to point (A). Low side to chassis.	A12	Adjust to place sound marker in trap notch as in Fig. 4. Video marker should be at 50%.
			207MC (10MC Swp)	205.25MC 209.75MC	12		A13	
			201MC (10MC Swp)	199.25MC 203.75MC	11		A14	
			195MC (10MC Swp)	193.25MC 197.75MC	10		A15	
			189MC (10MC Swp)	187.25MC 191.75MC	9		A16	
			183MC (10MC Swp)	181.25MC 185.75MC	8		A17	
			177MC (10MC Swp)	175.25MC 179.75MC	7		A18	
			85MC (10MC Swp)	83.25MC 87.75MC	6		A19	
			79MC (10MC Swp)	77.25MC 81.75MC	5		A20	
			69MC (10MC Swp)	67.25MC 71.75MC	4		A21	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A22	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A23	

RF AND MIXER ALIGNMENT

The RF and mixer portion of this receiver has been properly aligned at the factory and is very stable. Alignment of this portion of the receiver should not be required in the field.

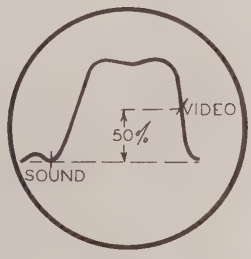


FIG. 4

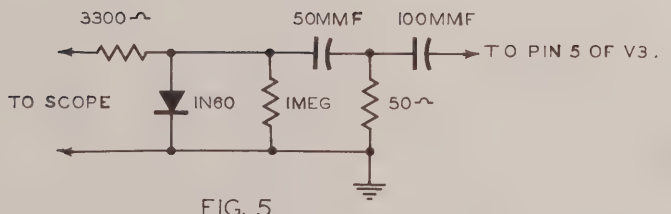
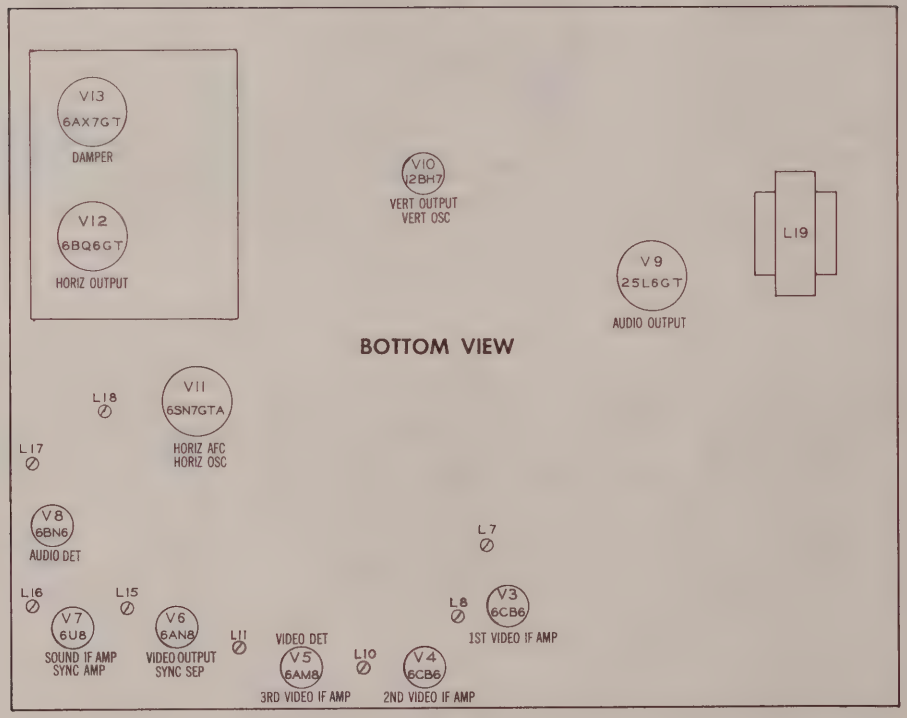


FIG. 5

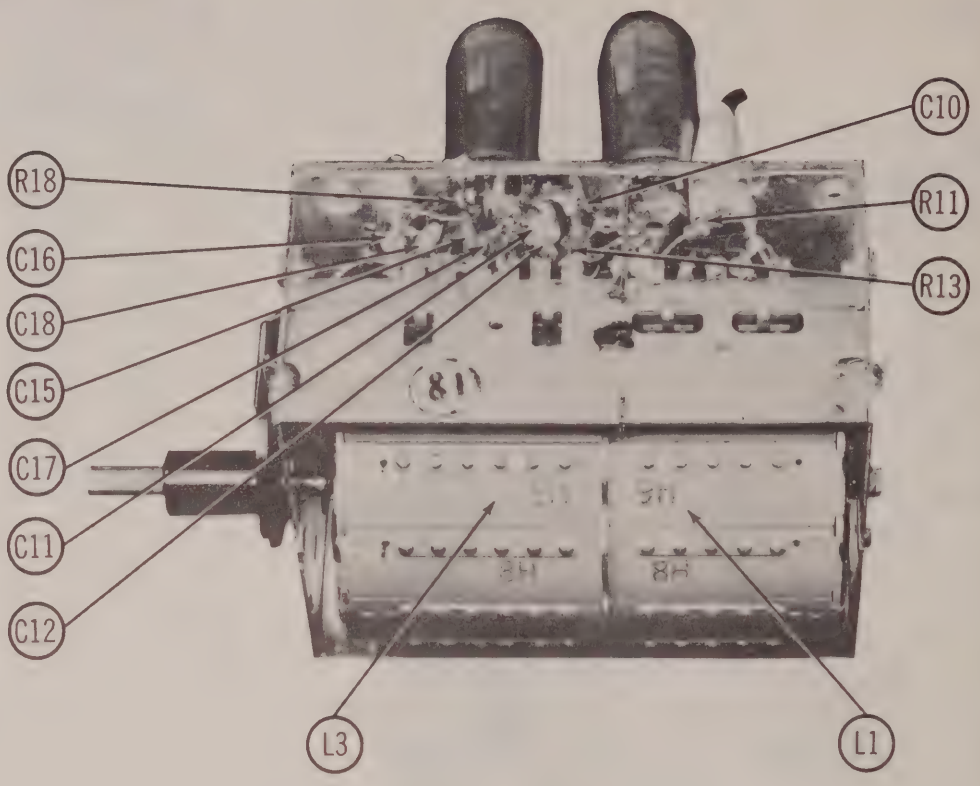
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BC5	1Meg	0Ω	.1Ω	0Ω	†1.2KΩ	†3.4KΩ	0Ω		
V 2	6J6	†15.2KΩ	†15.2KΩ	0Ω	.1Ω	225KΩ	10KΩ	0Ω		
V 3	6CB6	1Meg	47Ω	.1Ω	0Ω	†1.2KΩ	†1.2KΩ	0Ω		
V 4	6CB6	1Meg	47Ω	.1Ω	0Ω	†1KΩ	†1KΩ	0Ω		
V 5	6AM8	180Ω	.4Ω	†1KΩ	.1Ω	0Ω	†1KΩ	.4Ω	5.6KΩ	0Ω
V 6	6AN8	†820KΩ	2.2Meg	0Ω	.1Ω	0Ω	■7KΩ	■39KΩ	1Meg	250Ω
V 7	6U8	†11.5KΩ	.8Ω	†18KΩ	.1Ω	0Ω	†18KΩ	150Ω	0Ω	22KΩ
V 8	6BN6	200Ω	3Ω	.1Ω	0Ω	†5.6KΩ	5Ω	■330KΩ		
V 9	25L6GT	INF	0Ω	■245Ω	■53Ω	300KΩ	8.2KΩ	1.5Ω	†0Ω	
V 10	12BH7	▲2.5Meg	700KΩ	0Ω	.1Ω	.1Ω	▲834Ω	▲2.5Meg	10KΩ	0Ω
V 11	6SN7GTA	860KΩ	■80KΩ	300KΩ	250KΩ	■28KΩ	0Ω	0Ω	.1Ω	
V 12	6BQ6GT	INF	.1Ω	■1KΩ	■18KΩ	470KΩ	INF	0Ω	22Ω	TOP CAP ■24Ω
V 13	6AX4GT	INF	INF	1.2Meg	INF	■53Ω	0Ω	1.2Meg	1.2Meg	
V 14	1X2B		PINS	1 - 8	HAVE	INF	RESISTANCE			TOP CAP ▲400Ω
V 15	17HP4	0Ω	20.5KΩ	PIN 6 †0Ω	PIN 10 ▲390KΩ	PIN 11 250KΩ	PIN 12 .1Ω			

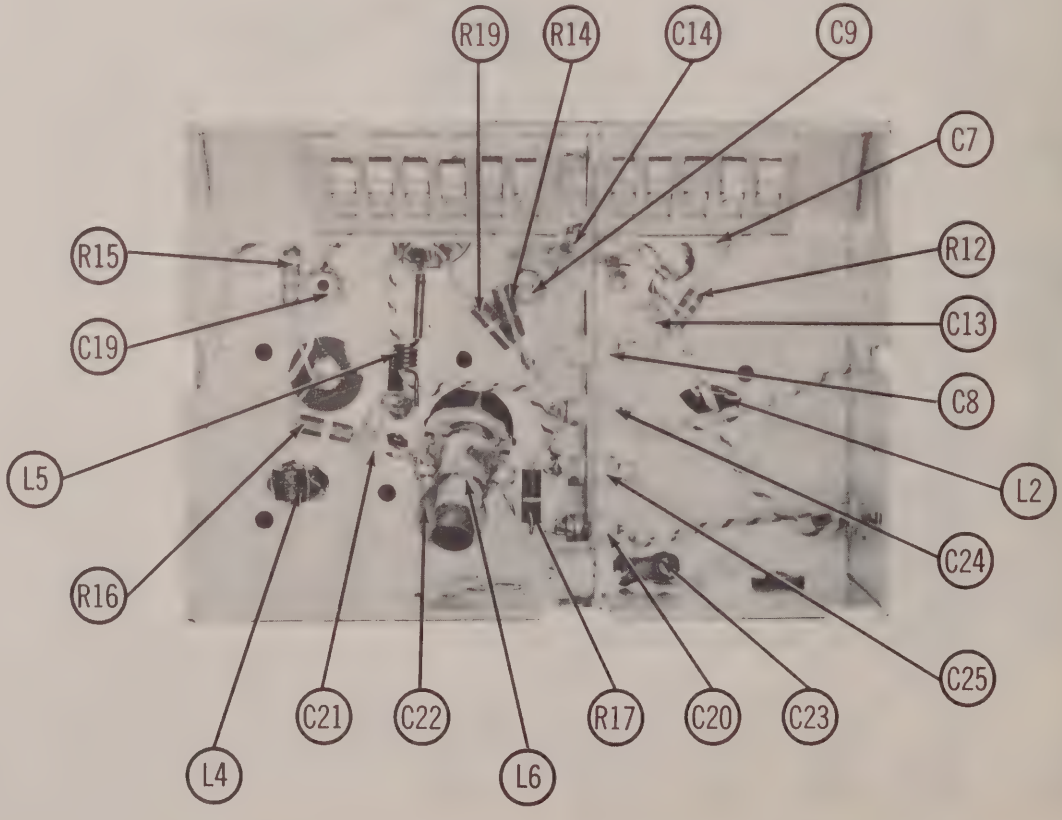
† MEASURED FROM 130V LINE
■ MEASURED FROM JUNCTION OF M2 & C2A
▲ MEASURED FROM PIN 3 OV V13



TUBE PLACEMENT CHART



RF TUNER-RIGHT SIDE



RF TUNER-BOTTOM VIEW

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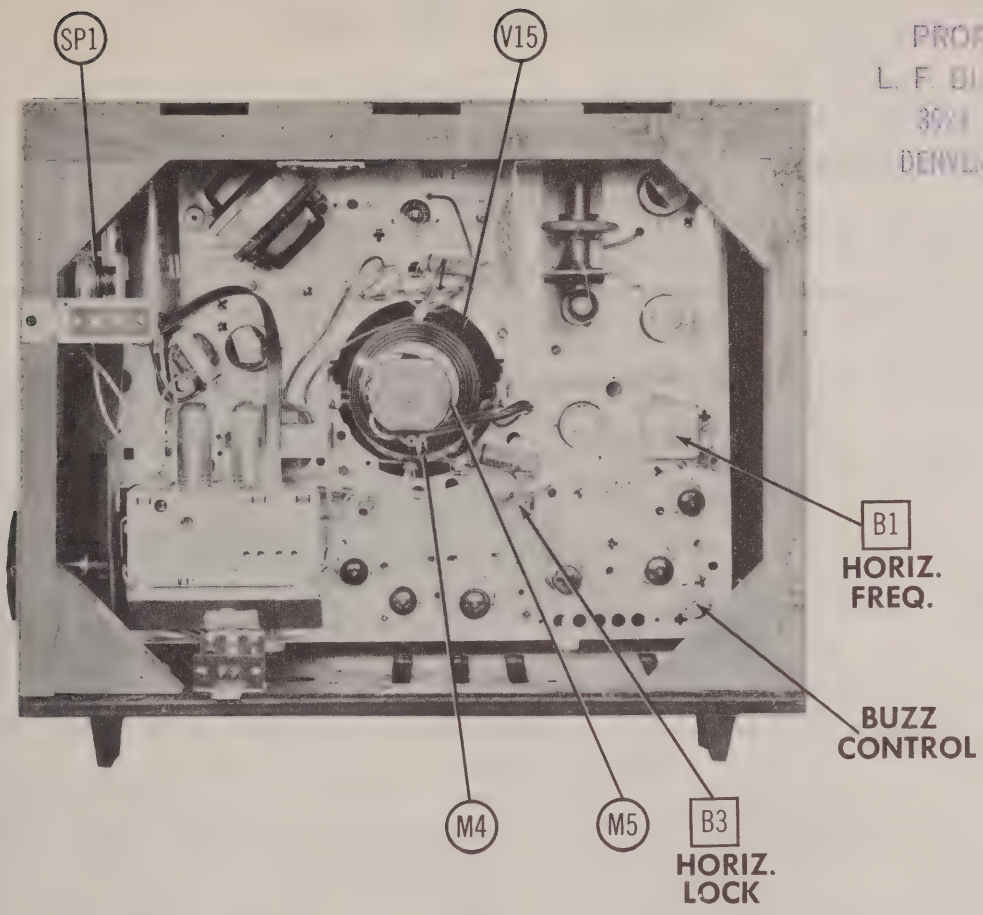


CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

Set the horizontal hold control to its mid-range position. If necessary, adjust the horizontal frequency slug (B1) to synchronize the picture horizontally.

Connect the vertical amplifier of an oscilloscope through a 10MMF capacitor to terminal # 4 of L18.

Adjust the horizontal waveform slug (B2) for waveform similar to Fig. 6. If necessary, keep the picture in sync during this adjustment with the horizontal hold control or B1 .

Disconnect the scope. Turn the horizontal hold control fully counter clockwise. Turn B1 counter clockwise until picture loses sync with diagonal bars sloping downward to the right.

Adjust B1 clockwise until picture is just ready to fall into sync. Turn horizontal hold control clockwise until picture loses sync. If picture is still in sync at maximum clockwise rotation of horizontal hold control switch off channel and back so that picture will fall out of sync. Turn horizontal hold control slowly counter clockwise and note the number of diagonal bars present just before picture pulls into sync. If more than 3 bars are present adjust the horizontal lock trimmer (B3) slightly clockwise. If less than 2 bars are present adjust B3 slightly counter clockwise. Check horizontal hold control action. Picture should pull into sync within 60 degrees from fully counter clockwise rotation of horizontal hold control.

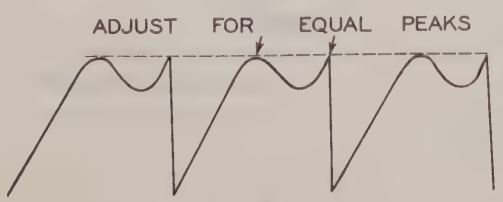


FIG. 6

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage".

INSUFFICIENT SWEEP

Check by substitution V12 and V13. Check M1 and M2. Check T3, T5A, R76 and other associated components.

DRIVE LINES

Check by substitution V12 and V13. Check L18, T3, T5A, C68, C69 and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V12 and V13. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V11, V12 and V13. Check C62, R66 and other associated components.

XMAS TREE EFFECT

Check by substitution V11, V12 and V13. Check L18, C67, C65, C68, R69, T3, T5A and other associated components.

VERTICAL

LOSS OF SWEEP

Check by substitution V10. Check waveform W7.

If Satisfactory	If Unsatisfactory
Check T4, T5B, R63, C60, R6 and other associated components.	Check T2, R7, C56 and other associated components.

INSUFFICIENT SWEEP

Substitute V10. Check height and vertical linearity controls for proper operation. Check components associated with V10. Check T4 abd T5B.

COMPRESSED AT BOTTOM

Substitute V10. Check R6, T2, C57 and other associated components.

COMPRESSED AT TOP

Substitute V10. Check R7, R61, R62, C4, C2D, C60 and other associated components.

FOLDS

Substitute V10. Check C57, C58, R43, T4, T5B and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V6 and V7. Check C52, R53, R54, R57, C53 and other associated components.

LOSS OF VERTICAL SYNC -HORIZONTAL SYNC SATISFACTORY

Substitute V10. Check T2, C55, C56, R1 and other associated components. Check vertical integrator network. Check video IF alignment for overloading.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Substitute V11. Check C61, C62, C64, C65, R69, R2 and other associated components.

HORIZONTAL BENDING

Check by substitution V6, V7 and V11. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Substitute V6, C40, C41, L14, R39, R38, R37 and other associated components.

SOUND BARS (4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check video IF alignment.

POOR CONTRAST

Substitute V6. Check video detector network. Check contrast control, picture tube and other associated components.

NEGATIVE PICTURE

Substitute V6. Check picture tube. Check video detector network. Check components associated with V6.

SMEAR

Substitute V6. Check L12, L13, L14, C41, C39 and other associated components. Check video IF alignment.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V3, V4, V5 and V6 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V7, V8 and V9. Check stage V9 using audio signal generator. Apply audio signal across C49.

If Satisfactory	If Unsatisfactory
Check audio IF and audio detector stages, especially R49, R47, C43 and C44.	Check C50, C51, T6, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Adjust R8 and L17 for minimum buzz. If still unsatisfactory check audio IF alignment.

DISTROTED

Follow procedure outlined under "Weak or No Sound".

POWER

DEAD SET

If filaments fail to light, check AC interlock. Check switch on volume control and T1. If filaments light check R77 fuse resistor, check M1 and M2. Check B+ filter and decoupling network.

SMALL AND/OR DIM PICTURE

Check M1 and M2. Check B+ filter and decoupling network.

PROPERTY OF
L. F. BLANKENSHIP
3904 MEADE ST.
DENVER, COLORADO

CHASSIS BOTTOM VIEW-TRANS., INDUCTOR AND ALIGNMENT IDENTIFICATION

HALLICRAFTERS
MODELS 17T310B, W, W (Ch. A1600D)

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: Hallicrafters PART No.	STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amp.		6BC5	7BD	
V2	Converter		6J8	7BF	
V3	1st. Video IF Amp.		6CB6	7CM	
V4	2nd. Video IF Amp.		6CB6	7CM	
V5	3rd. Video IF Amp.–Video Detector		6AM8	9CY	
V6	Video Output–Sync Separator		6AN8	9DA	
V7	Sound IF Amp.–Sync Amp.		6U8	9AE	
V8	Audio Detector		6BN6	7DF	
V9	Audio Output		25L6GT	7S	
V10	Vert. Oscillator–Vert. Output		12BH7	9A	
V11	Horiz. AFC–Horiz. Osc.		6BN7GTA	8BD	
V12	Horiz. Output		6BQ6GT	6AM	
V13	Damper		6AX4GT	4CG	
V14	HV Rectifier		1X2B	9Y	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: Hallicrafters PART No.	CBS-HYTRON PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V15	17HP4	17HP4	17HP4 or 17RP4	17HP4 17RP4	17HP4	12L 12L	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	VOLT	REPLACEMENT DATA: Hallicrafters PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1	140	300	45B262	AFHS1-73		E210400		FP218	TVL-2584	Red
C2A	140	300	45B263	E58C76		E210491			TVL-4563	Red
B	200	150								Green
C	5	300								Blue
D	30	150								
C3A	300	150	45B260	AFHS2-109		E210399		FP216.1	TVL-3444	Red
B	5	150								Yellow
C4	20	450	45B261	PRS450/20		BH2045		TC75	TVA-1709	
C5	470	2000	45A472	HVD30-00047	DD30-471			3KV-471	20GA-Q47	
C6	470	2000	45A472	HVD30-00047	DD30-471			3KV-471	20GA-Q47	
C7	3-8				829-3		3115-01-0R5	CT565A		
C8	800									
C9	.5-3				829-3		3115-01-0R5	CT565A		
C10	1000			BPD-001	DD-103	K069	801-001	DC-521	5HK-D1	
C11	120			BPD-00012	D6-121	G044	GP2K-121	UC-5312	5GA-T12	
C12	120			BPD-00012	D6-121	G044	GP2K-121	UC-5312	5GA-T12	
C13	1000			BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C14	800									
C15	120			BPD-00012	D6-121	G044	GP2K-121	UC-5312	5GA-T12	
C16	.5-3				829-3		3115-01-0R5	CT565A		
C17	10			SU10NP0	TCZ-10	Z018	NP0K-100	ZT-541	5GCC-Q1	
C18	23									
C19	.5-3				829-3		3114-01-0R5	CT565A		
C20	800									
C21	8.3			SI8.2MP0		Z016	NP0K-8R2			
C22	43									
C23	120			SU120	D6-121	TP25	GP2K-121	UC-5312	5GA-T12	
C24	800									
C25	800									
C26	1000		47A230	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C27	1000		47A230	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C28	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C29	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C30	1000		47A230	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C31	33	500		1469-00007		2E5Q68		MF-47		
C32	1000		47A230	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C33	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C34	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C35	1000		47A230	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C36	10		47CA20100F	SI10	D6-100	TP09	GP1K-100	UC-541	5GA-Q1	
C37	4.7		47A160-6	SI5NP0	TCZ-4.7	TZ07	NP0K-4R7	ZT-555	5TCC-V47	
C38	.25	100	46A242	P288-25		CUB2P25		PT402S	2TM-P25	
C39	.1	300	46A243	P288-1	DF-104	CUB2P1		PT41L	2TM-P1	
C40	33		47A478	SI33N080			N080L-330			
C41	.1	400	46AY1047	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C42	68		47A479				N080-337-680			
C43	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C44	.01	200	46AU103J	P488-01	D6-103	CUB4S1	GP2-333-103	PT41L	4TM-S1	
C45	33		47A478	SI33N080			N080L-330			
C46	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C47	.01	300	46AU103J	P488-01	D6-103	CUB4S1	GP2-333-103	PT41L	4TM-S1	
C48	15		47A480				N080K-150			
C49	1000		47A230	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C50	.03	200	46AU203J	P288-03	DF-203	CUB2S2	817-02	PT41Z	2TM-S2	
C51	.02	800	46AZ203J	P688-02	DF-203	CUB6S2	817-02	PT91Z	6TM-S2	
C52A	270			SI270		TP41	GP2K-271	UC-5327		
B	.01		†49A045	BPD-01	†PC-260	K061	811-01	DC-511	†102C17	
C	25			SI25		TP25	GP1K-250	UC-5425		
C53	.05	200	46AU503J	P288-05	DF-503	CUB2S5		PT41S	2TM-S5	
C54A	.005		‡48A044	BPD-005	‡PC-106	K060	811-005	DC-525	5HK-D5	
B	.005			BPD-006		K080	811-005	DC-525	5HK-D5	
C55	.01	400	46BR103E4							
C56	470		47CA2047K	SI470	D6-471	TP46	GP2K-471	UC-5347	5GA-T47	
C57	.047	400	46BR473L4	P488-047	DF-503	CUB4S47		PT41S	4TM-S47	
C58	.033	400	46BR333E4	P488-033		PJ4S33		PT41S3	4TM-S33	
C59	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C60	5000		47A168	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C61	20		47CA20200K	SI20	D6-200	G023	GP1K-200	UC-543	5GA-Q2	
C62	.05	400	46AW503J	P488-05	DF-503	CUB4S5		PT41S	4TM-S5	

CAPACITORS (cont)

ITEM No.	RATING: CAP.	VOLT	REPLACEMENT DATA: Hallicrafters PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C63	.02	200	46AU203J	P288-02	DF-203	CUB2S5	817-02	PT41Z	2TM-S2	
C64	.25	100	46A242	P288-25		CUB2P25		PT402S	2TM-P25	
C65	33		47A478	SI33N080			N080L-330			
C66	220	500	47X20B221K	1469-00025		2ER5T22		MCB340		
C67	.01	400	46C244							
C68	1300	500	47X30B132K			IR5D33				
C69	560		47CA25561K	SI560	D6-561	TP48	GP2K-561	UC-5366	5GA-T56	
C70	.05	400	46AW503J	P488-05	DF-503	CUB4S5		PT41S	4TM-S5	
C71	68	3000	47A473	HVD30-00068	DD30-680		3KV-680		30GA-Q68	
C72	.1	200	46AU104J	P288-1	DF-104	CUB2P1		PT40I	2TM-P1	
C73	47	2000		HVD30-00047	DD30-470		3KV-470		20GA-Q47	

† Items C52A, C52B, C52C, R53A, R53B, R53C are combined in one unit.
* Items C54A, C54B, R59A, R59B are combined in one unit.

CONTROLS

ITEM No.	RATING: RESISTANCE	WATTS	REPLACEMENT DATA: Hallicrafters PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1. 25Meg with 440K stop	½	25B1097	QII-137	A47-2Meg-S	B-75	U-155	Vert. Hold-Note 1
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A
R2A	145KΩ with 70K stop	½	25B1100	QII-125	A47-200K-S	B-46	U-48	Horiz. Hold-Note 2
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R2A
R3A	330KΩ	½	25B1101	Q13-132	A47-500K-Z	B-90-S	U-48	Volume
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R3A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R3A
R4	1500Ω	½	25B1102	Q17-109			U-5	Contrast
R5A	5 Meg	½	25B1096	Q17-141				Brightness
B	Shaft		Not Req.	SQ			U-4	Attach to R5A
R6A	750Ω	½	25B1099	QII-105	A47-750-S	AB-5	Not Req.	Vert. Linearity
B	Shaft		Not Req.	SQ	FKS-1/4	AK-1	Not Req.	Attach to R6A
R7A	5 Meg with 1Meg stop	½	25B1098	QII-141	A47-4Meg-S	AB-86	SU-67	Height-Note 3
B	Shaft		Not Req.	SQ	FKS-1/4	AK-1	Not Req.	Attach to R7A
R8	500Ω	1	25A1096		39-500			Buzz-wire wound

Note 1. Connect a 470KΩ resistor in series with the right hand terminal of the control and the lead connecting to the same terminal of the original control. (Control viewed from shaft end, terminals down).

Note 2. Connect a 68KΩ resistor in series with the right hand terminal of the control and the lead connecting to the same terminal of the original control. (Control viewed from shaft end, terminals down).

Note 3. Connect a 1 Meg resistor in series with the right hand terminal of the control and the lead connecting to the same terminal of the original control. (Control viewed from shaft end, terminals down).

RESISTORS

ITEM No.	RATING: OHMS	WATT	REPLACEMENT DATA: Hallicrafters PART No.	IRC PART No.	NOTES
R9	470KΩ	½		BTS-470K	
R10	470KΩ	½		BTS-470K	
R11	15KΩ	½		BTS-15K	
R12	47KΩ	½		BTS-47K	
R13	2200Ω	½		BTS-2200	
R14	1000Ω	½		BTS-1000	
R15	4700Ω	½		BTS-4700	
R16	220KΩ	½		BTS-220K	
R17	15KΩ	½		BTS-15K	
R18	10KΩ	½		BTS-10K	
R19	15KΩ	½		BTS-15K	
R20	1000Ω	½	23X20X102K	BTS-1000	
R21	2700Ω	½	23X20X272K	BTS-2700	
R22	47Ω	½	23X20X470K	BTS-47	
R23	15KΩ	½	23X20X153K	BTS-15K	
R24	1000Ω	½	23X20X102K	BTS-1000	
R25	220Ω	½	23X20X221K	BTS-220	
R26	1000Ω	½	23X20X102K	BTS-1000	
R27	47Ω	½	23X20X470K	BTS-47	
R28	1000Ω	½	23X20X102K	BTS-1000	
R29	12KΩ	½	23X20X123K	BTS-12K	
R30	180Ω	½	23X20X181K	BTS-180	
R31	1000Ω	½	23X20X102K	BTS-1000	
R32	1000Ω	½	23X20X102K	BTS-1000	
R33	18KΩ	½	23X20X183K	BTS-18K	
R34	1 Meg	½	23X20X105K	BTS-1 Meg	
R35	5600Ω	½	23X20X562K	BTS-5600	
R36	1 Meg	½	23X20X105K	BTS-1 Meg	
R37	39KΩ	1	23X30X393K	BTA-39K	
R38	10KΩ	2	23X60X103K		
R39	18KΩ	1	23X30X183K		
R40	47KΩ	1	23X30X473K	BTA-47K	
R41	100KΩ	½	23X20X104K	BTS-100K	
R42	15KΩ	½	23X20X153K	BTS-15K	
R43	560Ω	½	23X20X562K	BTS-5600	
R44	390KΩ	½	23X20X394K	BTS-390K	
R45	820KΩ	½	23X20X824K	BTS-820K	
R46	150Ω	½	23X20X151K	BTS-150	
R47	18KΩ	½	23X20X183K	BTS-18K	
R48	5600Ω	½	23X30X562K	BTA-5600	
R49	470Ω	½	23X20X471K	BTS-470	
R50	560KΩ	½	23X20X564K	BTS-560K	
R51	8200Ω	½	23X30X822K	BTS-8200	
R52	470KΩ	½	23X20X474X	BTS-470K	
R53A	10KΩ	½		BTS-10K	
B	330KΩ	½	†49A045	BTS-330K	
C	2. 2Meg	½		BTS-2. 2Meg	
R54	820KΩ	½	23X20X824K	BTS-820K	
R55	22KΩ	½	23X20X223K	BTS-22K	
R56	680KΩ	½	23X30X684X	BTS-680K	
R57	6800Ω	1	23X30X682K	BTA-6800	
R58	4700Ω	½	23X30X472X	BTS-4700	
R59A	22KΩ	½		BTS-22K	
B	10KΩ	½	‡49A044	BTS-10K	
R60	1000Ω	½	23X20X102K	BTS-1000	
R61	18KΩ	2	23X40X183K	BTB-18K	
R62	15KΩ	2	23X40X153K	BTB-15K	
R63	120Ω	½	23X20X121K	BTS-120	
R64	560KΩ	½	23X20X564K	BTS-560K	
R65	150KΩ	½	23X20X154K	BTS-150K	
R66	150KΩ	½	23X20X154K	BTS-150K	
R67	100KΩ	½	23X20X104K	BTS-100K	
R68	8200Ω	½	23X30B22K	BTS-8200	
R69	100KΩ	½	23X20X104K	BTS-100K	
R70	27KΩ	½	23X20X273K	BTS-27K	
R71	2. 7Meg	½	23X20X275X	BTS-2. 7Meg	
R72	150KΩ	½	23X20X154K	BTS-150K	
R73	18KΩ	½	23X20X183K	BTS-18K	
R74	470KΩ	½	23X20X474K	BTS-470K	
R75	22Ω	½	23X20X220K	BTS-22	
R76	18KΩ	2	23A096	BTB-18K	
R77	7. 5Ω	5	23B101		
R78	33KΩ	1	23X30X333X	BTA-33K	
R79	4700Ω	½		BTS-4700	
R80	33KΩ	½		BTS-33K	Note 1

† Items R53A, R53B, R53C, C52A, C52B, C52C are combined in one unit.
* Items R59A, R59B, C54A, C54B are combined in one unit.
Note 1. Not used in all models.

TRANSFORMER (FILAMENT)

ITEM No	RATING: PRI.	SEC 1	SEC 2	REPLACEMENT DATA: Hallicrafters PART No.	Stancor PART No.	Merit PART No	Triad PART No.	RCA TYPE No.	Halldorson PART No.	Thordarson PART No
T1	117VAC ⑨. 55A *	6. 3VAC		52C322						

* Primary tapped ⑨ 25VAC /. 32 Amp. and ⑩ 6. 3VAC/ 6 Amp.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No	USE	REPLACEMENT DATA: Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	RCA TYPE No.	Halldorson PART No.	Thordarson PART No.
T2	Vert. Osc. Trans.	55B250	A-8125	A-3003	A-97X		B8702	24A87①
T3	Horiz. Output Trans.	55D251					FB417*	
T4	Vert. Output Trans.	S5C249	A-8140② ③	A-308X① ④	A-130X ①		21805②③	26857②
T5A	Yoke-Horiz. (23MH)	53D324	DY-10⑤⑥ ⑦	MDF-74 ⑤⑥⑦	Y-20⑤⑥ ⑦	214D1 ⑤ ⑥⑦	DF603 ⑤ ⑥⑦	Y-1L⑤⑥⑦
B	Vert. (3. 5MH)							

① Drill one new mounting hole.
② Drill new mounting holes.
③ Connect as auto transformer.
④ Use 50 to 1 turns ratio.
⑤ Use original yoke network.
⑥ Use original yoke cover and positioning device.
⑦ Connect jumper from terminal #3 to terminal #8 or #5.

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

ORIGINAL TERMINAL CONNECTIONS	Stancor Replacement Connections	Merit Replacement Connections	Triad Replacement Connections	RCA Replacement Connections	Halldorson Replacement Connections	Thordarson Replacement Connections
4					4	
3					3	
1					1	
2					2	

TRANSFORMER (AUDIO OUTPUT)

ITEM No	IMPEDANCE: PRI	SEC	REPLACEMENT DATA: Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	NOTES
T6	2. 4KΩ	3. 3Ω	55B348	A-3332	A-3025	S-12X	21101	24S50 ①	① Drill one new mounting hole.

SPEAKER

ITEM No.	RATINGS: SIZE	FIELD	V C IMP	REPLACEMENT DATA: Hallicrafters PART No.	JENSEN PART No.	QUAM PART No.	NOTES
SP1	4'	PM	3. 3Ω	85C175A	ST-113 Mod. P4-X	4A07	

COILS (RF-IF)

ITEM No.	USE	DC RES.: PRI.	SEC.	REPLACEMENT DATA: Hallicrafters PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	Ant. Coils	OOCT	0Ω					
L2	Fil. Choke	0Ω						
L3	RF Mixer Grid & Osc. Coils	0Ω						
L4	Fil. Choke	0Ω						
L5	RF Choke	0Ω						
L6	Conv. Plate	. 6Ω						
L7	1st Video IF	. 6Ω		51A1861	17-1003	TV-102	837LA	
L8	2nd Video IF	. 3Ω	. 3Ω	51A1854	17-1082		6350	
L9	Fil. Choke	0Ω		53A282	19-3001		6175	
L10	3rd Video IF	. 3Ω	. 6Ω	51A1862			6353	Includes 21. 9MC trap
L11	4th Video IF	. 5Ω	. 6Ω	50A623			6187	
L12	Series Peak. Coil	4Ω		53A307			4634	
L13	Shunt Peak. Coil	17Ω		51A1855	19-3660		4661	750Microhenries; wound on 4. 7KΩ resistor
L14	Series Peak. Coil	9. 5Ω		51A1856	19-4350	TV-187	6173	324 Microhenries; Wound on 27KΩ resistor
L15	1st Sound IF	2. 8Ω	. 8Ω	51A1858				
L16	2nd Sound IF	2Ω	3Ω	51A1859				
L17	Quadrature Coil	5Ω		51A1857	20-1005	TV-151	1469	
L18	Horiz. Osc.	120Ω	* 37. 5Ω	50B622	20-1401	TV-161	6182	* Tapped ⑨ 83Ω

FILTER CHOKE

ITEM No.	RATINGS: TOTAL DIRECT CURRENT	D. C. RESISTANCE	INDUCTANCE @ CURRENT 1000 ⁰C)	REPLACEMENT DATA: Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L19	.180ADC	53Ω	.85 Hy.	56B187	C-2327	C-2994	C-81X ①	C5040	28C41

① Drill one new mounting hole.

PARTS LIST AND DESCRIPTIONS (Continued)

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	Hallicrafters PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	SARKES TARZIAN PART No.	SELETRON PART No.	
M1	.180ADC	27A173	1236A	RS250	6S300	300	6Q4	
M2	.180ADC	27A173	1236A	RS250	6S300	300	6Q4	

MISCELLANEOUS

ITEM No.	PART NAME	Hallicrafters PART No.	NOTES
M3	Tuner	D2017	VHF
M4	Centering Device		Part of yoke cover (See T5)
M5	Ion Trap	21B188	
B3	Trimmer Cap.		Horiz. Lock (10-160MMF)
	Cabinet	78F1131	Walnut wood - Model 17T310W
	Cabinet	78A1137	Mahogany wood - Model 17T310M
	Cabinet	78A1138	Blonde wood - Model 17T310B
	Knob	15D762	Fine tuning
	Knob	15D761	Channel Selector
	Knob	15A775	Control (4 used)
	Safety Glass	22C423	
	Mask	7C574	

TROUBLE SHOOTING AIDS (cont)

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V11, V12, V13 and V14. Check waveform W12.

If Satisfactory	If Unsatisfactory
Check T3, T5A, C71, C70, R76 and other associated components.	Check L18, C69, C66, C67, R69, R7 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V11, V12 and V13. Check M1 and M2. Check T3, T5A, R76 and other associated components.

BLOOMING

Check by substitution V12, V13 and V14. Check M1 and M2. Check T3, T5A and other associated components.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or No Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5, and V6. Check video IF components.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

KEYSTONE EFFECT

Check T5 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustments of the VHF Tuner Oscillator Circuit may be accomplished by removal of the Channel Selector and Fine Tuning knobs. The adjustments are accessible, one at a time, through the small hole in the cabinet to the right of the Channel Selector shaft.

PICTURE TUBE SAFETY GLASS CLEANING

For picture tube safety Glass cleaning, it is necessary to remove chassis. (See disassembly instructions.)

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions.)

SERVICE ADJUSTMENT LOCATION

See tube placement chart Page 5.

HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

For adjustment of the Horiz. Oscillator, it is necessary to remove the rear cover and supply power to set. Adjustment is located on top of chassis. Set the Horiz. Hold Control at the center of its range and adjust the Horiz. Freq. slug (L18) until, picture synchronizes horizontally. (For location see tube placement chart.)

SOUND IF DETECTOR BUZZ ADJUSTMENT

Adjust the buzz control located on rear apron of chassis for maximum volume and minimum buzz. If results are unsatisfactory see alignment instructions on Page 6.

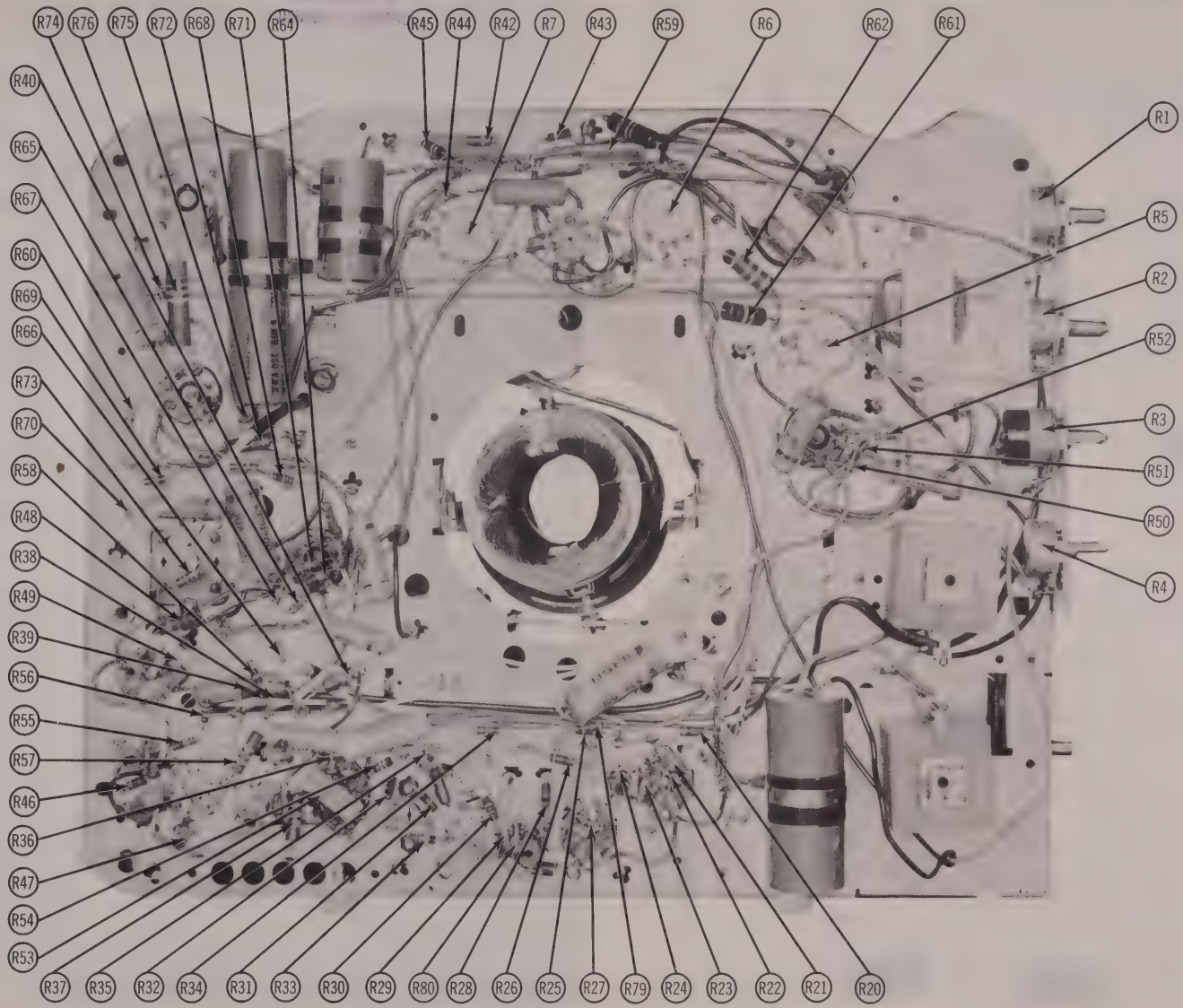
CENTERING

Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

1. Remove 6 push-on type control knobs from side of cabinet.
2. Remove 4 wood screws. Remove rear cover.
3. Remove 1 wood screw. Remove antenna bracket.
4. Unsolder speaker leads.
5. Remove 2 speaker wing nuts. Remove speaker.
6. Remove 3 wood screws and 4 machine screws from bottom of chassis mounting board.
7. Remove 2 wood screws from rear underside top of cabinet. (Chassis brace)
8. Remove cabinet by pushing forward and up.

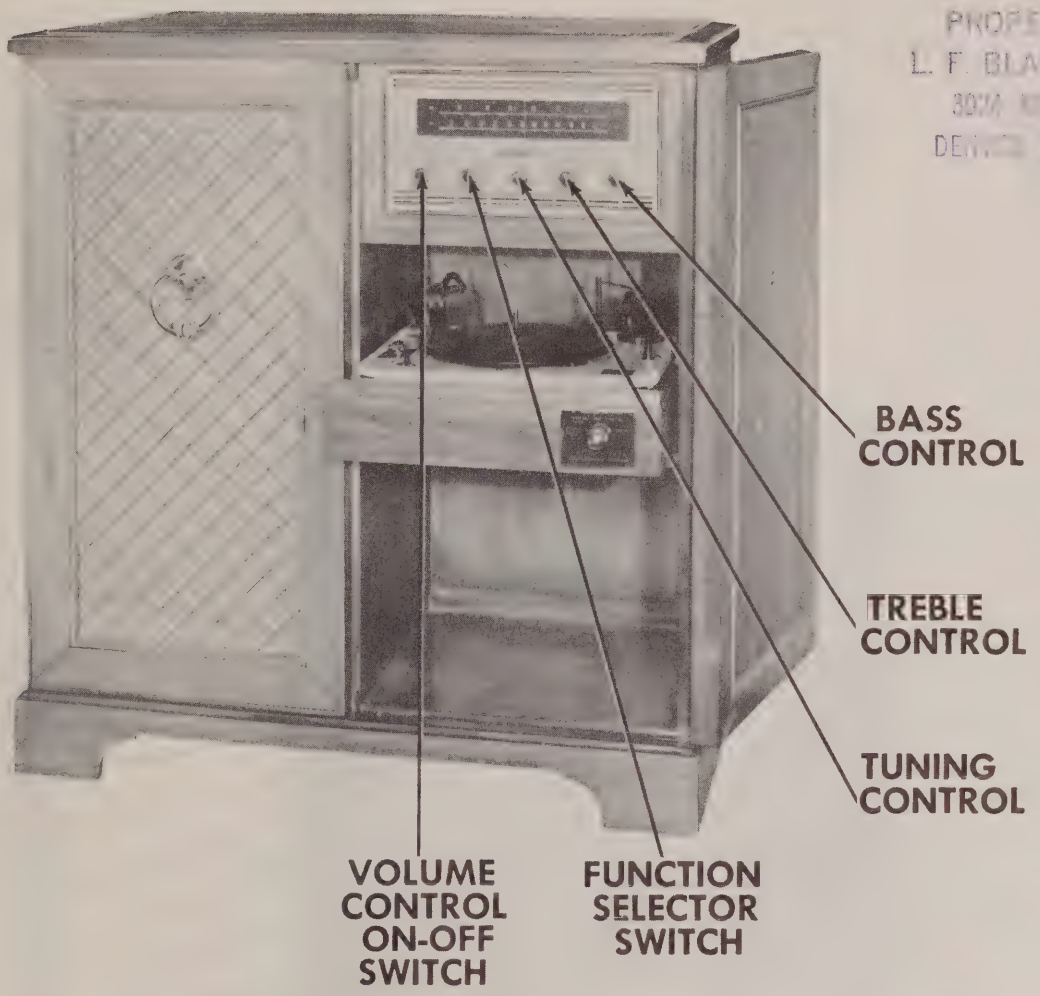
PROPERTY OF
L. F



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PROPERTY OF
L. F. BLANKENSHIP
[illegible]

HALLICRAFTERS
MODELS 1621, 1622 (Run 1)



HALLICRAFTERS
MODELS 1621, 1622 (Run 1)

TRADE NAME	Hallicrafters Models 1621, 1622 (Run 1)
MANUFACTURER	The Hallicrafters Co., 4401 W. 5th. Ave., Chicago 24, Ill.
TYPE SET	AC Operated AM-FM Tuner With 10 Watt Audio Amplifier & 3 Speed Automatic Record Changer
TUBES	Seventeen (Total)
POWER SUPPLY	105-125 Volts AC-60 Cycles RATING .61 Amp. @ 117 Volts AC
TUNING RANGE - BROADCAST	535-1750KC FREQ.MOD. 88-108MC

FOR SERVICE INFORMATION ON RECORD CHANGER UNIT - HALLICRAFTERS PART NO. 115A147 - SEE GARRARD MODEL RC-80 PHOTOFACT SET #157, FOLDER #5 OR RECORD CHANGER MANUAL CM-4.

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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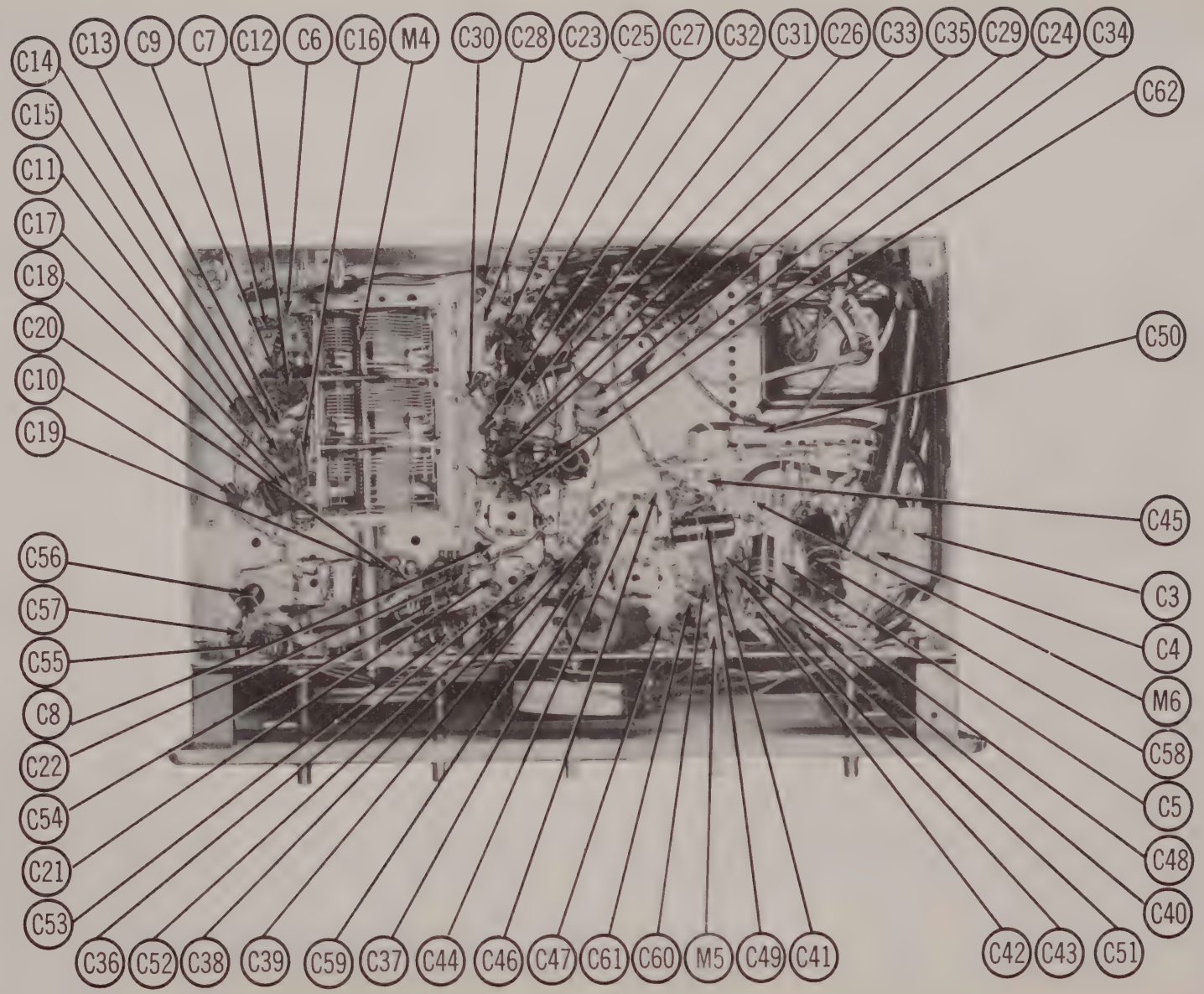
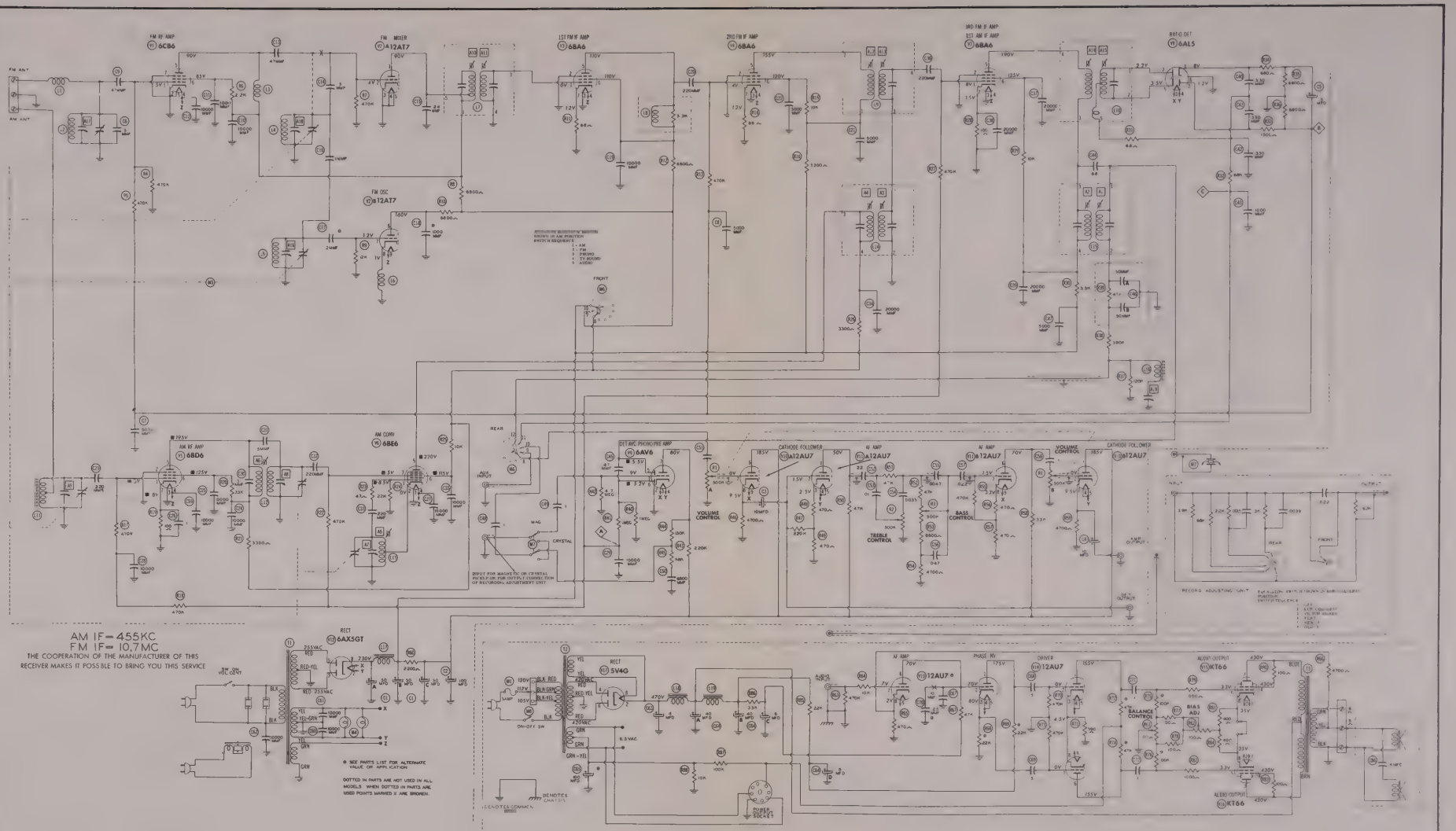


TUNER CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION


AM IF = 455KC
FM IF = 10.7MC
THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE
FM RF AMP V1 6CB6
FM MIXER V7 12AT7
1ST FM IF AMP V3 6BA6
2ND FM IF AMP V4 6BA6
3RD FM IF AMP 1ST AM IF AMP V5 6BA6
RATIO DET V9 6AL5
FM OSC V7 12AT7
AM RF AMP V1 6BD6
AM CONV V6 6BE6
DET AVC PHONO PRE AMP V6 6AV6
CATHODE FOLLOWER V10 12AU7
AF AMP V10 12AU7
AF AMP V11 12AU7
VOLUME CONTROL
CATHODE FOLLOWER V8 12AU7
TREBLE CONTROL
BASS CONTROL
RECT V12 6AX5GT
RECT V11 5V4G
AF AMP V13 12AU7
PHASE INV V13 12AU7
DRIVER V12 12AU7
BALANCE CONTROL
BIAS ADJ
AUDIO OUTPUT V14 KT66
AUDIO OUTPUT V15 KT66
FRONT
REAR
MAG
CRYSTAL
ON-OFF SW
POWER SOCKET
DENOTES CHASSIS
DENOTES COMMON
* SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION
DOTTED IN PARTS ARE NOT USED IN ALL MODELS. WHEN DOTTED IN PARTS ARE USED POINTS MARKED X ARE BROKEN.

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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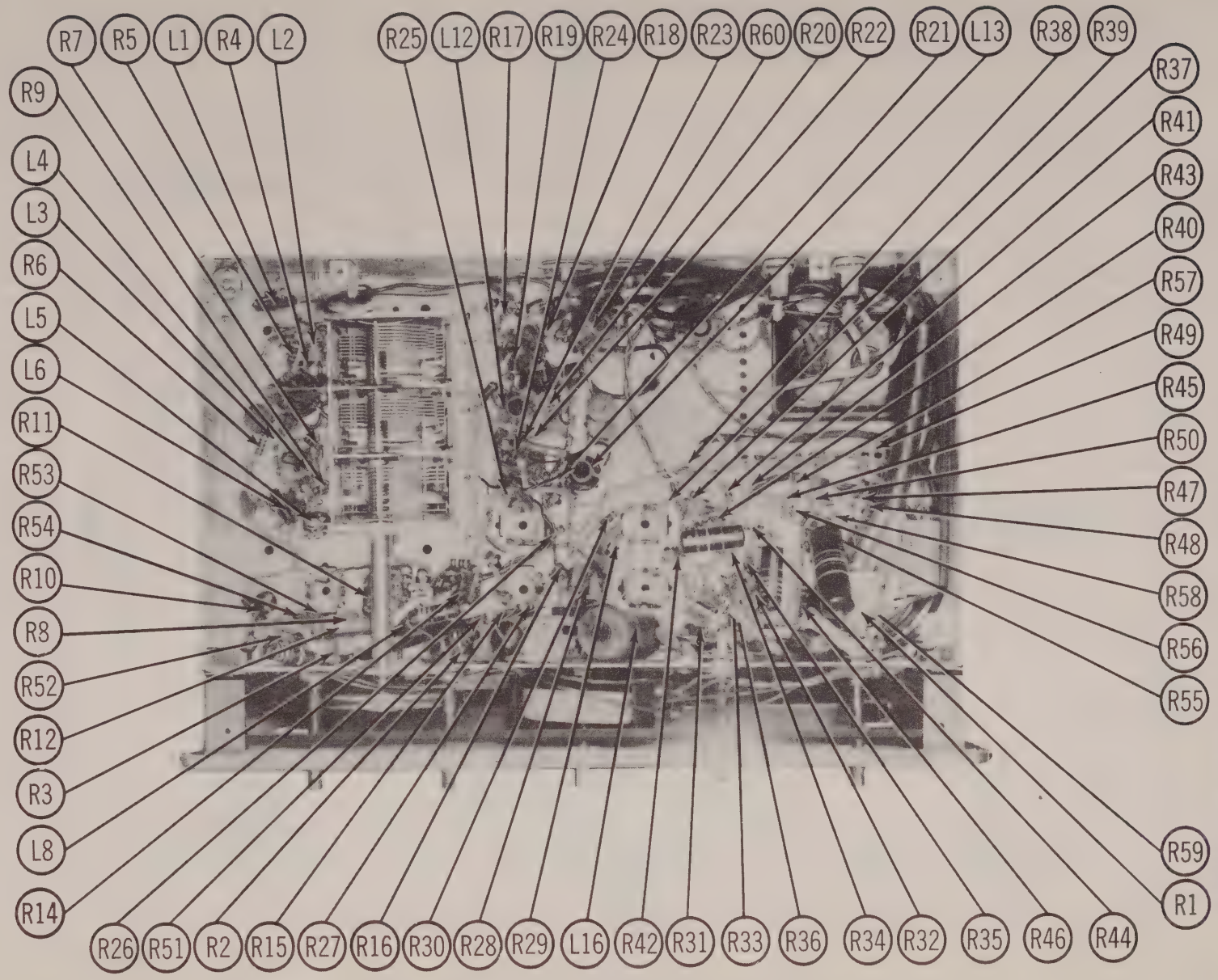
253-8



TUNER CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PROPERTY OF
L. F. BLANKENSHIP
3944 MEADE ST.
DENVER, COLORADO

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Allow 10 minute warm-up period for tuner and test equipment.
Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.
Set bass and treble controls to their mid-range positions.
Use only enough generator output to produce useable indication on VTVM.
To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial.

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1.	.01MFD	High side to pin 7 (grid) of 6BE6 (V8). (Disconnect C32 from pin 7) . Low side to chassis.	455KC (Unmod)	AM	1000KC	DC probe to point Ⓐ . Common to chassis.	A1, A2, A3, A4	Adjust for maximum deflection. Reconnect C32 to pin 7 (grid) of 6BE6 (V8).
2.		Loop	600KC	"	Tune to 600KC signal	"	A5, A6	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.
3.		"	1400KC	"	Tune to 1400KC signal	"	A7, A8, A9	"

FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Disconnect FM antenna.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
4.	.005MFD	High side to pin 2 (grid) of 12AT7 (V2). (disconnect C14 from pin 2). Low side to pin 3 (cathode)	10.7MC	FM	90MC	DC probe to point Ⓑ . Common to chassis.	A10, A11 A12, A13 A14	Adjust for maximum deflection. Attenuate generator output to maintain 1 volt at VTVM.
5.	"	"	"	"	"	DC probe to point Ⓒ . Common to chassis.	A15	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting. Reconnect C14 to pin 2 (grid) of 12AT7 (V2).

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Disconnect FM antenna.
Use frequency modulated signal with 60% modulation and 450KC sweep. Use 120% sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
4.	.005MFD	High side to pin 2 (grid) of 12AT7 (V2). (Disconnect C14 from pin 2). Low side to pin 3 (cathode).	10.7MC (450KC Swp)	FM	90MC	Vert. Amp. to point Ⓑ . Low side to chassis.	A10, A11, A12, A13, A14	Disconnect stabilizing capacitor C5. Adjust for curve of maximum amplitude and symmetry similar to Fig. 1.
5.	"	"	"	"	"	Vert. Amp. to point Ⓒ . Low side to chassis.	A15	Reconnect stabilizing capacitor C5. Adjust so that 10.7MC occurs at center of crossover lines as in Fig. 2. SLIGHTLY retouch A14 for maximum amplitude and straightness of crossover lines. Reconnect C14 to pin 2 (grid) of 12AT7 (V2).

FM RF ALIGNMENT

Disconnect FM antenna.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
6.	300Ω carbon resistor	High side to FM antenna terminal. Low side to chassis.	90MC	FM	90MC	DC probe to point Ⓑ . Common to chassis.	L5, L4, L2	Adjust for maximum deflection by compressing or expanding coil turns.
7.	"	"	105MC	"	105MC	"	A16, A17	Adjust for maximum deflection.
8.	"	"	105MC	"	105MC	"	A18	Adjust for maximum deflection while rocking tuning gang thru 105MC signal. Repeat steps 6, 7 and 8 until proper tracking with maximum sensitivity is obtained.

10KC WHISTLER FILTER ALIGNMENT

Connect amplifier to tuner.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
9.		Loop	1400KC (10KC Mod)	AM	1400KC	Across amplifier speaker terminals	A19	Adjust for MINIMUM output.

AMPLIFIER BALANCE AND HUM ADJUSTMENTS

If either V15 or V16 (KT-66'S) are replaced it will be necessary to readjust the balance control (R61A) and the bias control (R62A) as follows:

(a) Disconnect the link on the two terminal strip beneath the chassis and connect a DC voltmeter across these two terminals. Adjust R61A for zero reading (use lowest voltmeter, scale). It may be impossible to obtain zero reading due to a difference in operating characteristics of V15 and V16. If a reading below 1 volt cannot be obtained, tube substitution will be required until a reading of one volt or less is obtained.

(b) Replace the link on the terminal strip. Connect the positive lead of the voltmeter to the link and the negative lead to chassis. Adjust R62A for + 38 volts on DC voltmeter.

FIG. 1

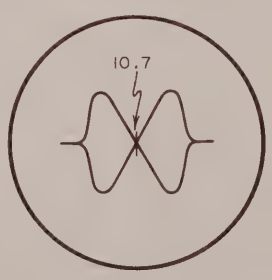
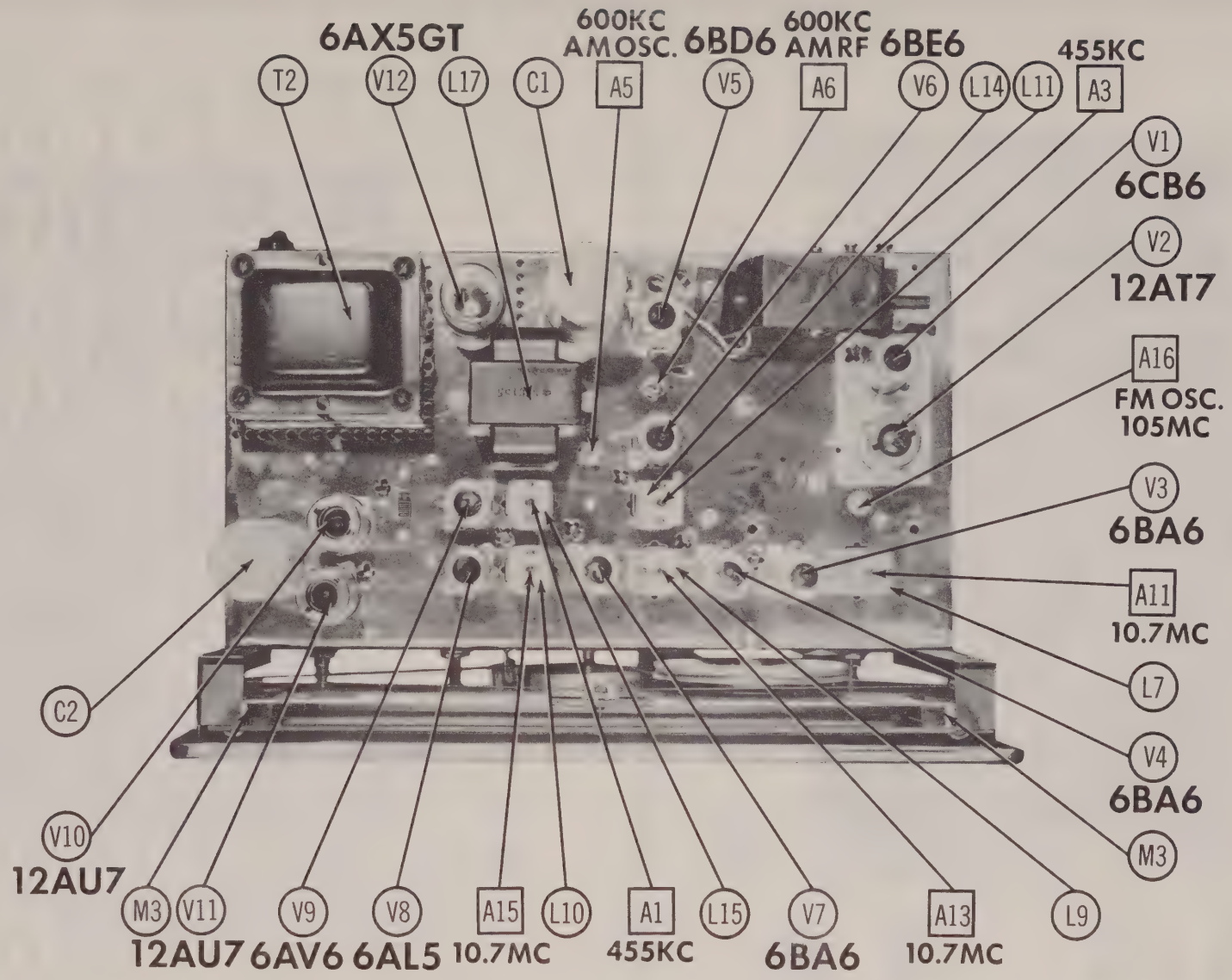


FIG. 2



TUNER CHASSIS- TOP VIEW

PROPERTY OF
L. F. BLANKENSHIP
[redacted] MEADE ST.
DENVER, COLORADO

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Allow 10 minute warm-up period for tuner and test equipment.
Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.
Set bass and treble controls to their mid-range positions.
Use only enough generator output to produce useable indication on VTVM.
To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial.

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
1.	.01MFD	High side to pin 7 (grid) of 6BE6 (V8). (Disconnect C32 from pin 7) . Low side to chassis.	455KC (Unmod)	AM	1000KC	DC probe to point Ⓐ . Common to chassis.	A1, A2, A3, A4	Adjust for maximum deflection. Reconnect C32 to pin 7 (grid) of 6BE6 (V8).
2.		Loop	600KC	"	Tune to 600KC signal	"	A5, A6	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.
3.		"	1400KC	"	Tune to 1400KC signal	"	A7, A8, A9	"

FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Disconnect FM antenna.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
4.	.005MFD	High side to pin 2 (grid) of 12AT7 (V2). (disconnect C14 from pin 2). Low side to pin 3 (cathode)	10.7MC	FM	90MC	DC probe to point Ⓑ . Common to chassis.	A10, A11 A12, A13 A14	Adjust for maximum deflection. Attenuate generator output to maintain 1 volt at VTVM
5.	"	"	"	"	"	DC probe to point Ⓒ . Common to chassis.	A15	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting. Reconnect C14 to pin 2 (grid) of 12AT7 (V2).

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Disconnect FM antenna.
Use frequency modulated signal with 60% modulation and 450KC sweep. Use 120% sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
4.	.005MFD	High side to pin 2 (grid) of 12AT7 (V2). (Disconnect C14 from pin 2). Low side to pin 3 (cathode).	10.7MC (450KC Swp	FM	90MC	Vert. Amp. to point Ⓑ . Low side to chassis.	A10, A11, A12, A13, A14	Disconnect stabilizing capacitor C5. Adjust for curve of maximum amplitude and symmetry similar to Fig. 1.
5.	"	"	"	"	"	Vert. Amp. to point Ⓒ . Low side to chassis.	A15	Reconnect stabilizing capacitor C5. Adjust so that 10.7MC occurs at center of crossover lines as in Fig. 2. SLIGHTLY retouch A14 for maximum amplitude and straightness of crossover lines. Reconnect C14 to pin 2 (grid) of 12AT7 (V2).

FM RF ALIGNMENT

Disconnect FM antenna.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
6.	300Ω carbon resistor	High side to FM antenna terminal. Low side to chassis.	90MC	FM	90MC	DC probe to point Ⓑ . Common to chassis.	L5, L4, L2	Adjust for maximum deflection by compressing or expanding coil turns.
7.	"	"	105MC	"	105MC	"	A16, A17	Adjust for maximum deflection.
8.	"	"	105MC	"	105MC	"	A18	Adjust for maximum deflection while rocking tuning gang thru 105MC signal. Repeat steps 6, 7 and 8 until proper tracking with maximum sensitivity is obtained.

10KC WHISTLER FILTER ALIGNMENT

Connect amplifier to tuner.

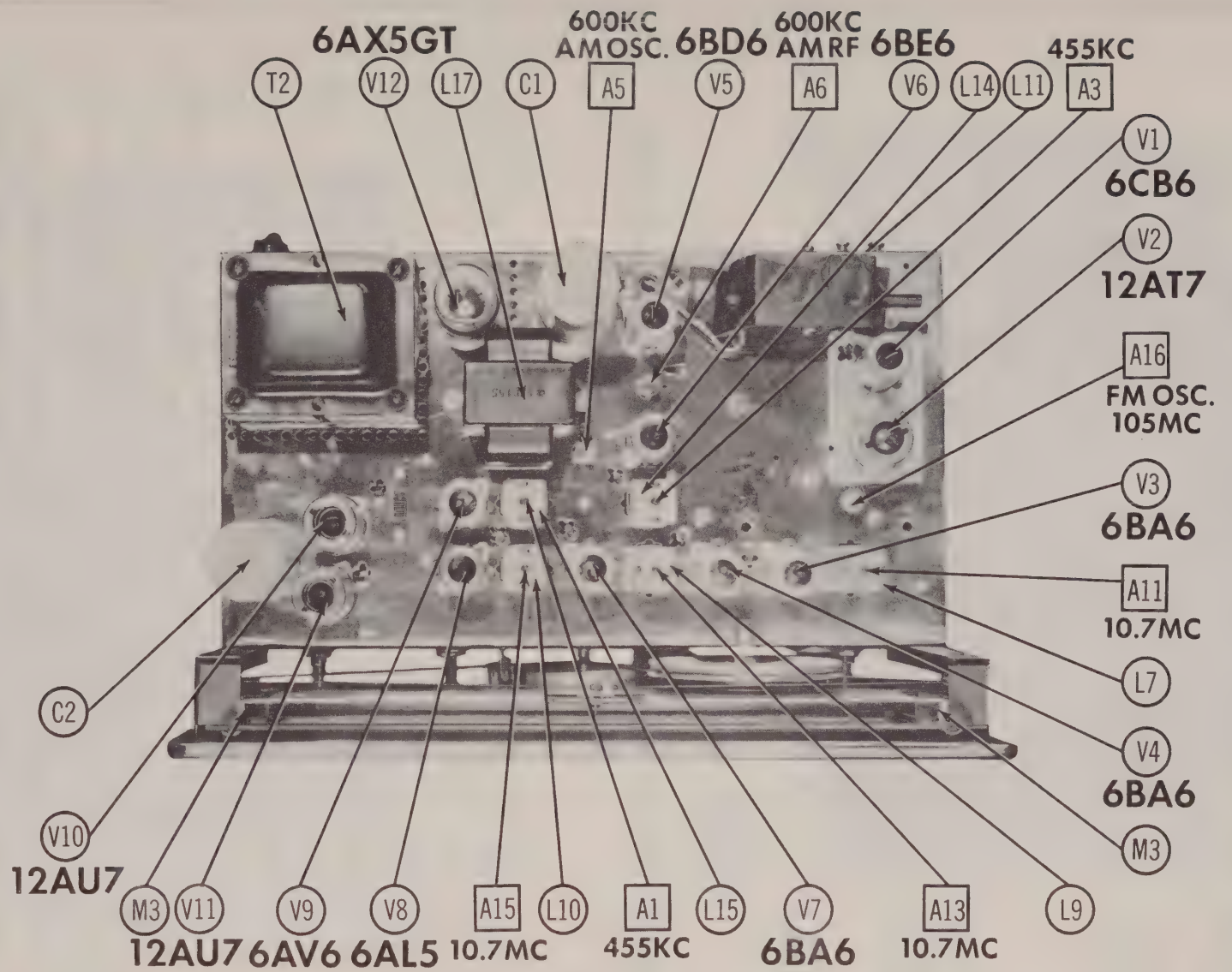
	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
9.		Loop	1400KC (10KC Mod)	AM	1400KC	Across amplifier speaker terminals	A19	Adjust for MINIMUM output.

AMPLIFIER BALANCE AND HUM ADJUSTMENTS

If either V15 or V16 (KT-66'S) are replaced it will be necessary to readjust the balance control (R61A) and the bias control (R62A) as follows:
(a) Disconnect the link on the two terminal strip beneath the chassis and connect a DC voltmeter across these two terminals. Adjust R61A for zero reading (use lowest voltmeter, scale). It may be impossible to obtain zero reading due to a difference in operating characteristics of V15 and V16. If a reading below 1 volt cannot be obtained, tube substitution will be required until a reading of one volt or less is obtained.
(b) Replace the link on the terminal strip. Connect the positive lead of the voltmeter to the link and the negative lead to chassis. Adjust R62A for + 38 volts on DC voltmeter.

FIG. 1

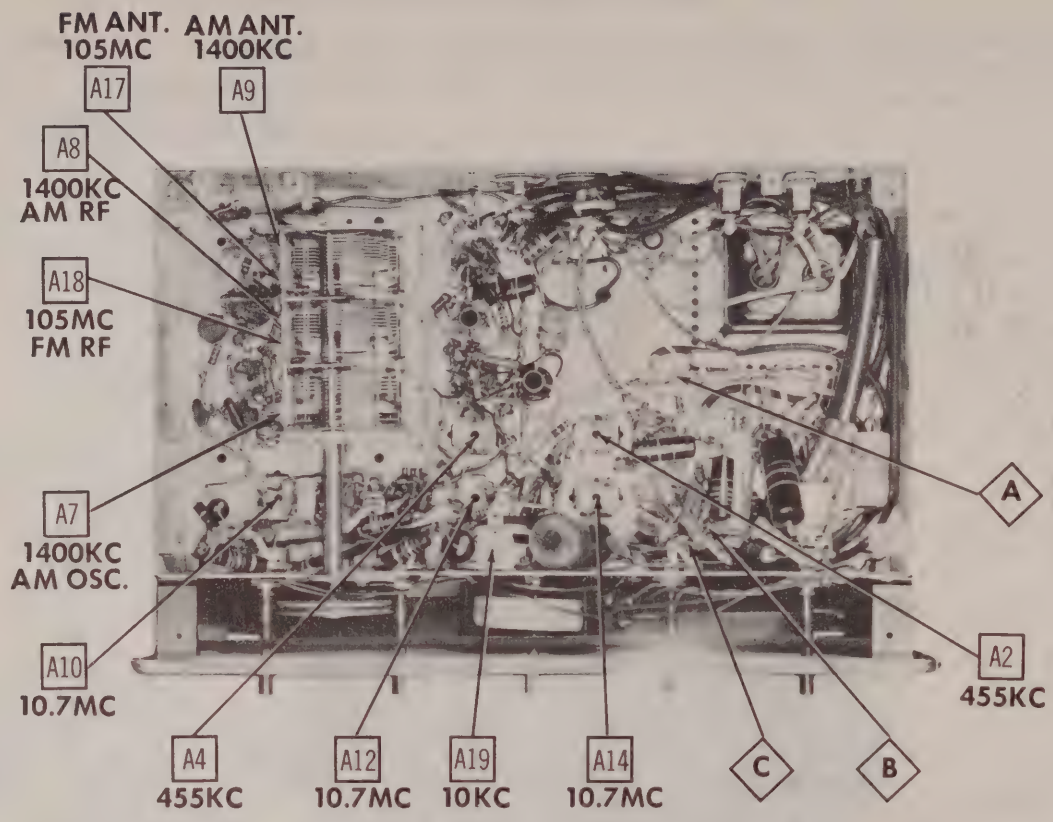
FIG. 2



TUNER CHASSIS- TOP VIEW

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

HALLICRAFTERS
MODEL 1621



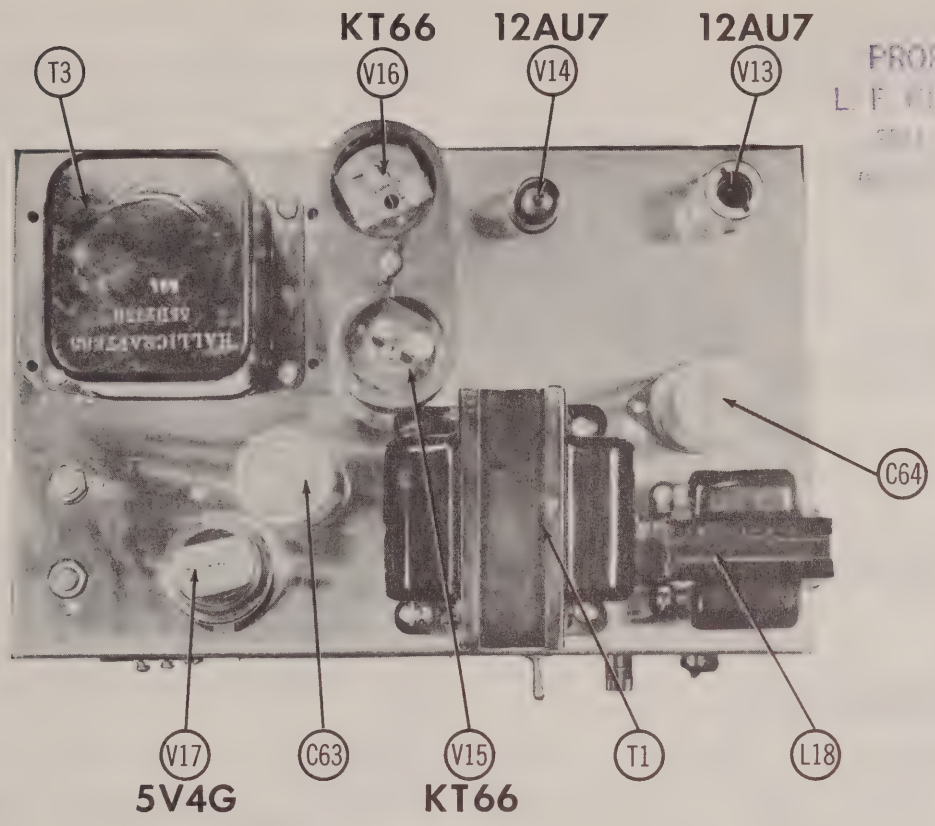
TUNER CHASSIS BOTTOM VIEW- ALIGNMENT IDENTIFICATION

RESISTANCE READINGS

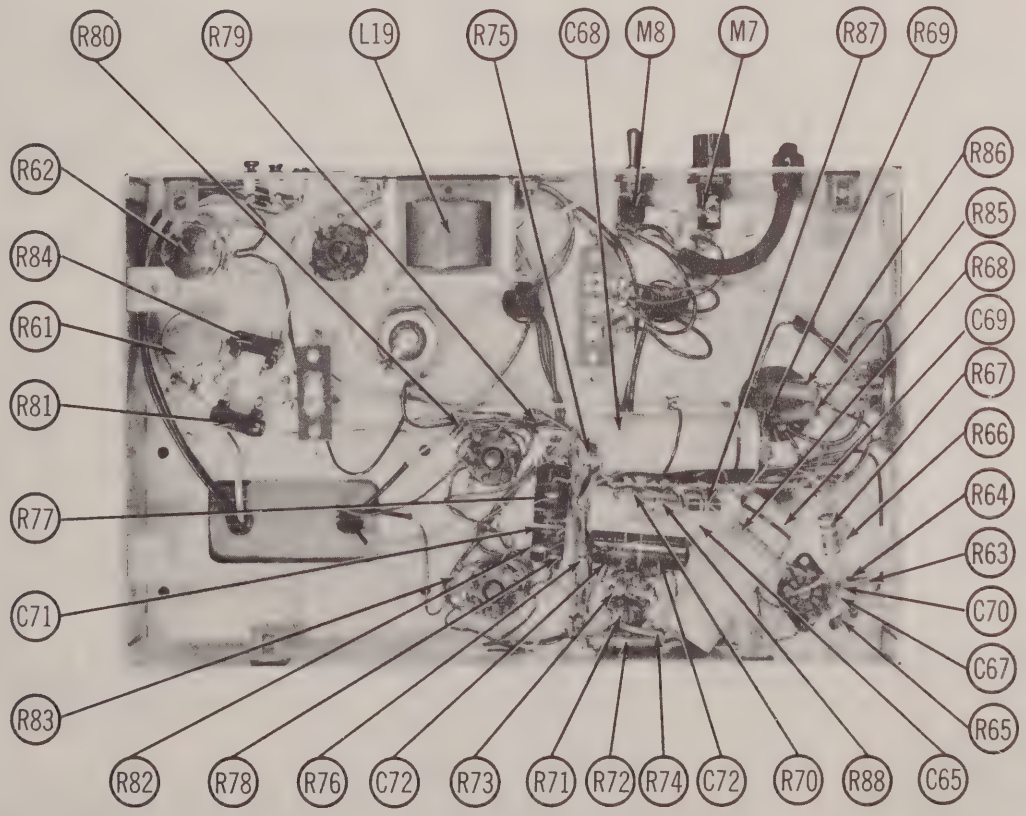
Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6CB6	235KΩ	0Ω	0Ω	.1Ω	†7KΩ	†9.2KΩ	0Ω		
V 2	12AT7	†7KΩ	470KΩ	0Ω	0Ω	0Ω	†7KΩ	12KΩ	1Ω	.1Ω
V 3	6BA6	.8Ω	0Ω	0Ω	.1Ω	†7KΩ	†7KΩ	68Ω		
V 4	6BA6	470KΩ	0Ω	0Ω	.1Ω	†3.5KΩ	†13.5KΩ	68Ω		
V 5	6BD6	3Meg	0Ω	0Ω	.1Ω	†■3.5KΩ	†■36KΩ	100Ω		
V 6	6BE6	22KΩ	.4Ω	0Ω	.1Ω	†■3.5KΩ	†■13.5KΩ	2.5Meg		
V 7	6BA6	2.5Meg	0Ω	0Ω	.1Ω	†3.5KΩ	†13.5KΩ	100Ω		
V 8	6AL5	7.5KΩ	8.3KΩ	.1Ω	.1Ω	INF	0Ω	INF		
V 9	6AV6	4.7Meg	0Ω	.1Ω	.1Ω	560KΩ	1Meg	†220KΩ		
V 10	12AU7	†2.4KΩ	500KΩ	4.7KΩ	.1Ω	.1Ω	†2.4KΩ	500KΩ	4.7KΩ	.1Ω
V 11	12AU7	†50KΩ	220KΩ	940Ω	.1Ω	.1Ω	†35KΩ	470KΩ	940Ω	.1Ω
V 12	6AX5GT	INF	.1Ω	55Ω	INF	55Ω	INF	.1Ω	200KΩ	
V 13	12AU7	▲45KΩ	▲80KΩ	22KΩ	10KΩ	10KΩ	▲80KΩ	480KΩ	470Ω	10KΩ
V 14	12AU7	48KΩ	470KΩ	390Ω	10KΩ	10KΩ	48KΩ	470KΩ	390Ω	10KΩ
V 15	KT66	INF	10KΩ	▲570Ω	▲670Ω	100KΩ	INF	10KΩ	325Ω	
V 16	KT66	INF	10KΩ	▲570Ω	▲670Ω	100KΩ	INF	10KΩ	325Ω	
V 17	5V4G	INF	100KΩ	INF	70Ω	INF	70Ω	INF	100KΩ	

ALL MEASUREMENTS ARE IN FM POSITION UNLESS OTHERWISE DESIGNATED
■ MEASURED IN AM POSITION
† MEASURED FROM PIN 8 OF V12
▲ MEASURED FROM PIN 8 OF V17

PROPERTY OF
L. F. CLARKENSHIP



AUDIO CHASSIS—TOP VIEW



AUDIO CHASSIS—BOTTOM VIEW

TUNER PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA Hallicrafters PART No.	REPLACEMENT DATA STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	FM RF Amplifier	6CB6	6CB6	7CM	
V2	FM Mixer & Osc.	12AT7	12AT7	9A	
V3	1st FM IF Amp.	6BA6	6BA6	7BK	
V4	2nd FM IF Amp.	6BA6	6BA6	7BK	
V5	AM RF Amplifier	6BD6	6BD6	7BK	
V6	AM Converter	6BE6	6BE6	7CH	
V7	3rd FM IF Amp. - 1st AM IF Amp.	6BA6	6BA6	7BK	
V8	Ratio Detector	6AL5	6AL5	6BT	
V9	Det-AVC - Phono Pre. Amp.	6AV6	6AV6	7BT	
V10	Cathode Follower	12AU7	12AU7	9A	
V11	AF Amplifier	12AU7	12AU7	9A	
V12	Rectifier	6AX5GT	6AX5GT	6S	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA Hallicrafters PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	▲50	350	45B225			C035		FP444.8 TC68	R1524	
B	■50	350								
C	▲50	350								
C2	▲100	350	45B231	AFH1-43		A041		FP140	TVL-1638	
C3	10	50	45B211	PRS50/10		BR105		TC32	TVA-1304	
C4	10	50	45B211	PRS50/10		BR105		TC32	TVA-1304	
C5	5	50	45B175	PRS150/4		BR550		TC30	TVA-1303	
C6	5		47X20UK050M	SI5	D6-050	TP06	GP1K-050	NT-555	5TCUB-V5	
C7	5000		47A168	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C8	5000		47A168	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C9	47		47X20UJ470K	SI47	D6-470	TP29	GP1K-470	UC-5447	5GA-Q47	
C10	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C11	1000		47B230	BPD-0001	DD-102	K069	801-001	DC-521	5HK-D1	
C12	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C13	47		47X20SJ470K				N330L-470			
C14	51		47X20UK510K/D	SI5IN750	TCN-51	TN15	N750K-510			
C15	24		47X20UK240K	SI24N750	TCN-24	TN07	N750K-240			
C16	1		47X20UJ010C	SI1NP0	TCZ-1	TZ03	NP0K-1		5TCCB-V1	
C17	2			SI2NP0			NP0K-2			Note 1
C18	1000			BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	Note 2
C19	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C20	220		47CA20A221K	SI220	D6-221	TP39	GP2K-221	UC-5322	5GA-T22	
C21	5000		47A168	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C22	5000		47A168	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C23	220		47CA20A221K	SI220	D6-221	TP39	GP2K-221	UC-5322	5GA-T22	
C24	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C25	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C26	.1	200	46A207	P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C27	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C28	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C29	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C30	51		47XUK510K/D	SI5IN750	TCN-51	TN15	N750K-510			
C31	5		47A160-6	SI5	D6-050	TP06	GP1K-050	NT-555	5GA-V5	
C32	220		47X32UK221K/D	SI220N750	TCN-220	TN30	N750M-221		5TCU-T22	
C33	220		47X32UK221K/D	SI220N750	TCN-220	TN30	N750M-221		5TCU-T22	
C34	20000		47A242	BPD-02	DF-203	K085		DC-512	5HK-S2	
C35	10000		47A224	BPD-02	DF-203	K085		DC-512	5HK-S2	
C36	220		47CA20A221K	SI220	D6-221	TP39	GP2K-221	UC-5322	5GA-T22	
C37	20000		47A242	BPD-02	DF-203	K085		DC-512	5HK-S2	
C38	20000		47A242	BPD-02	DF-203	K085		DC-512	5HK-S2	
C39	20000		47A242	BPD-02	DF-203	K085		DC-512	5HK-S2	
C40	330		47CA25A331K	SI330	D6-331	TP43	GP2K-331	UC-5333	5GA-T33	
C41	330		47CA25A331K	SI330	D6-331	TP43	GP2K-331	UC-5333	5GA-T33	
C42	330		47CA25A331K	SI330	D6-331	TP43	GP2K-331	UC-5333	5GA-T33	
C43	1000	500	47X25B102K	1464-001		5W5D1		MC255	MS-21	
C44	.68		47A160-1		TCZ-.68	TZ02				
C45	47		47X20UJ470K	SI47	D6-470	TP29	GP2K-470	UC-5447	5GA-Q47	

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA Hallicrafters PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C46A	50		♦	♦PA-99	♦PC-52	♦111TM3	♦1403-03	UC-545	♦100C3	
B	50							UC-545		
C47	5000		47A168	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C48	.1	200	46A207	P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C49	.1	200	46A207	P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C50	6800	500	47X20B682K	1469-0007		1D3D68			1FM-37	
C51	.1	200	46A207	P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C52	.22	400	46A212	P488-22		CUB4P22		PT4022	4TM-P22	
C53	.01	400	46A208	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C54	.0033	400	46A210	P688-0033	D6-332	CUB6D33	GP2-333-332	PT6233	6TM-D33	
C55	.0047	400	46A218	P688-0047	D6-472	CUB6D47	GP2-333-472	PT6247	6TM-D47	
C56	.047	400	46A211	P488-047	DF-503	CUB4S47		PT4147	4TM-S47	
C57	.022	400	46A209	P488-022		CUB4S22		PT4122	4TM-S22	
C58	.1	600	46A214	P688-1	DF-104	CUB6S1		PT611	6TM-P1	
C59	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C60	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C61	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C62	10000		47A224	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	

Note 1. Some models may use a 1MMF in this application.
Note 2. Some models may use a 330MMF in this application.
♦ Items C46A, C46B, R39 are combined in one unit.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA Hallicrafters PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500KΩ	½	25B1020	Q13-133			UF55A	Volume
B	500KΩ	½		M13-133			UR55A	Volume
C	Shaft		Not Req.	Not Req.			DS-36	Attach to R1A
D	Switch		Not Req.	76-1			US-26	Attach to R1B
R2A	500KΩ	½	25B1019	Q11-133	A47-500K-S	B-59	U-50	Treble
B	Shaft		Not Req.	Not Req.	RS-3	Not Req.	Not Req.	Attach to R2A
R3A	500KΩ	½	25B1019	Q11-133	A47-500K-S	B-59	U-50	Bass
B	Shaft		Not Req.	Not Req.	RS-3	Not Req.	Not Req.	Attach to R3A

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Hallicrafters PART No.	IRC PART No.	NOTES
R4	470KΩ	½	23X20X474K	BTS-470K	
R5	470KΩ	½	23X20X474K	BTS-470K	
R6	2200Ω	½	23X20X222 K	BTS-2200	
R7	470KΩ	½	23X20X474K	BTS-470K	
R8	6800Ω	2	23X40X682K	BTB-6800	
R9	12KΩ	½	23X20X123K	BTS-12K	
R10	6800Ω	2	23X30X682K	BTB-6800	
R11	68Ω	½	23X20X680K	BTS-68	
R12	6800Ω	2	23X40X682K	BTB-6800	
R13	470KΩ	½	23X20X474K	BTS-470K	
R14	68Ω	½	23X20X680K	BTS-68	
R15	10KΩ	½	23X20X103K	BTS-10K	
R16	3300Ω	½	23X20X332K	BTS-3300	
R17	470KΩ	½	23X20X474K	BTS-470K	
R18	470KΩ	½	23X20X474K	BTS-470K	
R19	100Ω	½	23X20X101K	BTS-100	
R20	33KΩ	½	23X20X333K	BTS-33K	
R21	3300Ω	½	23X20X332K	BTS-3300	
R22	470KΩ	½	23X20X474K	BTS-470K	
R23	47Ω	½	23X20X470K	BTS-47	
R24	22KΩ	½	23X20X223K	BTS-22K	
R25	10KΩ	1	23X30X103K	BTA-10K	
R26	3300Ω	½	23X20X332K	BTS-3300	
R27	470KΩ	½	23X20X 474K	BTS-470K	
R28	100Ω	½	23X20X101K	BTS-100	
R29	10KΩ	½	23X20X103K	BTS-10K	
R30	3300Ω	½	23X20X332K	BTS-3300	
R31	68Ω	½	23X20X680K	BTS-68	
R32	68KΩ	½	23X20X683K	BTS-68K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Hallicrafter PART No.	IRC PART No.	NOTES
R33	1500Ω	½	23X20X152K	BTS-1500	
R34	680Ω	½	23X20X681K	BTS-680	
R35	6800Ω	½	23X20X682K	BTS-6800	
R36	6800Ω	½	23X20X682K	BTS-6800	
R37	120KΩ	½	23X20X124K	BTS-120K	
R38	390KΩ	½	23X20X394K	BTS-390K	
R39	47KΩ	½	♦	BTS-47K	
R40	1 Meg	½	23X20X105K	BTS-1 Meg	
R41	1 Meg	½	23X20X105K	BTS-1 Meg	
R42	4. 7Meg	½	23X20X474K	BTS-4. 7Meg	
R43	220KΩ	½	23X20X224K	BTS-220K	
R44	150KΩ	½	23X20X154K	BTS-150K	
R45	68KΩ	½	23X20X683K	BTS-68K	
R46	4700Ω	½	23X20X472K	BTS-4700	
R47	220KΩ	½	23X20X224K	BTS-220K	
R48	470Ω	½	23X20X471K	BTS-470	
R49	470Ω	½	23X20X471K	BTS-470	
R50	47KΩ	1	23X30X473K	BTA-47K	
R51	47KΩ	½	23X20X473K	BTS-47K	
R52	47KΩ	½	23X20X473K	BTS-47K	
R53	6800Ω	½	23X20X682K	BTS-6800	
R54	4700Ω	½	23X20X472K	BTS-4700	
R55	470KΩ	½	23X20X474K	BTS-470K	
R56	470Ω	½	23X20X471K	BTS-470	
R57	470Ω	½	23X20X471K	BTS-470	
R58	33KΩ	1	23X30X333K	BTA-33K	
R59	4700Ω	½	23X20X472K	BTS-4700	
R60	2200Ω	2	23X40X222K	BTB-2200	

♦ Items R39, C46A, C46B are combined in one unit.

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @ .61A	500VCT .084ADC	6.3VCT @ 2.8A	6.3VAC @ 2A	52C265					

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	Hallicrafters PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	FM Antenna Loading Coil	0Ω		53A278	19-1001		4604	1.56 Microhenries
L2	FM Ant. Coil	0Ω		51A1646				
L3	FM RF Choke	2.1Ω		53A008	19-6022		4624	16 Microhenries
L4	FM RF Coil	0Ω		51A1645				
L5	FM Osc. Coil	0Ω		51A1644				
L6	Cathode Choke	1Ω		53A280	19-1004		4610	7.5 Microhenries
L7	1st FM IF	1Ω	.9Ω	50C245	16-3487 *	FM-254 *	1463 *	Pri. tapped @ .6Ω
L8	RF Choke	3.5Ω		53A279				Wound on 3.3KΩ resistor
L9	2nd FM IF	1.8Ω	.5Ω	50C246	16-3487	FM-254	1463	
L10	Ratio Det.	1.6Ω	.9ΩCT	50C560	17-3488 †	FM-255	1465	Tertiary winding=.2Ω
L11	AM Ant. Coil	1.4Ω		51B1605				Tapped @ .1Ω
L12	AM RF Coil	65Ω	8.5Ω	51B1607	14-1027	BC-382	72-RF	
L13	AM Osc. Coil	4Ω		51B1606		BC-381 ▲	71-Osc.	Tapped @ .4Ω
L14	1st AM IF	19Ω	19Ω	50C244	16-6758	BC-352	12-C1	
L15	2nd AM IF	18Ω	18Ω	50C247	16-6758	BC-353	12-C2	

* Connect plate of V2 to one side of primary winding; connect B+ to other side of primary winding.
† Cut out chassis hole and drill mounting holes.
▲ Use secondary winding.

10KC FILTER CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA					
	TOTAL DIRECT CURRENT	D.C. RESISTANCE	INDUCTANCE (0 CURRENT 1000 ~)	Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L16		142Ω	1.66HY	56B160					

FILTER CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA					
	TOTAL DIRECT CURRENT	D.C. RESISTANCE	INDUCTANCE (0 CURRENT 1000 ~)	Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L17	.084A	255Ω	10.1HY	56C155	C-1709 ①		C-17X ①	C5019	20C53 ①

① Drill one new mounting hole.

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA							REMARKS
	Hallicrafters PART No.	ASTATIC PART No.		SHURE PART No.		ELECTRO-VOICE PART No.		
		CARTRIDGE	NEEDLE	CARTRIDGE	NEEDLE	CARTRIDGE	NEEDLE	
M1	* 121A103							* Less dual needle assembly.

PARTS LIST AND DESCRIPTIONS (Continued)

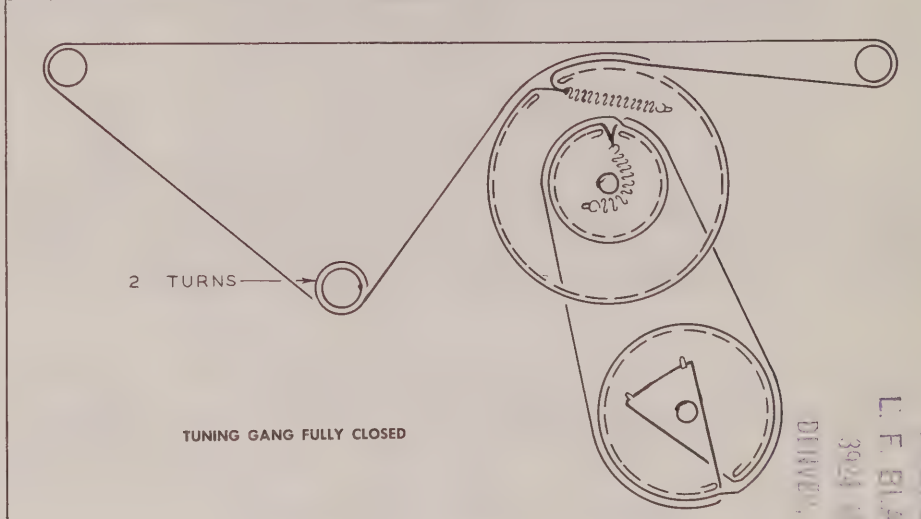
PHONO NEEDLE

(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

ITEM No.	REPLACEMENT DATA				REMARKS
	Hallicrafters PART No.	JENSEN PART No.	PERMO PART No.	WALCO PART No.	
M2	121A104	† GE-11	†AC-410 •† AC-410DI • AC-410D	† W-66TPS	† Jewel • Diamond

MISCELLANEOUS

ITEM No.	PART NAME	Hallicrafters PART No.	NOTES
M3	Dial light	39A003	# 44-2 used
M4	Tuning cap	48C298	(22-330MMF, 14-330MMF, 23-130MMF)
M5	Switch	60B511	Function selector
M6	Switch	60A381	Crystal/magnetic
	Cabinet	78F1068	Model 1621-mahogany
	Cabinet	78F1069	Model 1622-maple
	Knob	15B685	Tuning
	Knob	15B686	Volume, selector, treble & bass-4 used



DIAL CORD STRINGING

PROPERTY OF
L. F. BLANKENSHIP
3944 QUADE ST.
DENVER, COLORADO

AUDIO CHASSIS PARTS LIST ON NEXT PAGE

AUDIO PARTS LIST AND DESCRIPTIONS (Continued)

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: Hallicrafters PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V13	AF Amplifier - Phase Inverter	12AU7	12AU7	9A	
V14	Driver	12AU7	12AU7	9A	
V15	Output	KT66	KT66	7S	
V16	Output	KT66	KT66	7S	
V17	Rectifier	5V4G	5V4G	5L	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: Hallicrafters PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C63	4	600	46B206	GL600/4		KR604C		HS691	AP46	
C64A	▲40	500	45B222	AFH2-72				FP288	R1525	
B	■40	500		PRS450/8-8				TCD71		
C	▲8	400								
D	8	400								
C65	100	50		PRS50/100		BRH501		TC3501	TVA-1310	Note 3
C66	4	50		PRS150/4		BR550		TC30	TVA-1303	
C67	10		47CA20100F	SII0NP0	TCZ-10	TZ09	NP0K-100	NT-541	5TCC-Q1	
C68	.5	600	46C202	P688-1	DF-104	CUB6P1		PT601	6TM-P1	
C69	.5	600	46C202	P688-1	DF-104	CUB6P1		PT601	6TM-P1	
C70	25		SI25	D6-250	TP25	GP1K-250		UC-5425	5GA-Q25	Note 4
C71	.1	600	46B203	P688-5		CUB6P5		PT605	6TM-P5	
C72	.1	600	46B203	P688-5		CUB6P5		PT605	6TM-P5	

Note 3. Some models use a 10MFD @ 50V in this application.
Note 4. Not used in all models.

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: Hallicrafters PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R61A	100Ω	2	25B1018	W-100	A43-100	VK-121	R100L	Balance -wire wound
B	Shaft		Not Req.	Not Req.	FKS-1/4	Not Req.	Not Req.	Attach to R61A
R62A	100Ω	2	25B1018	W-100	A43-100	VK-121	R100L	Bias-wire wound
B	Shaft		Not Req.	Not Req.	FKS-1/4	Not Req.	Not Req.	Attach to R62A

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: Hallicrafters PART No.	IRC PART No.	NOTES
R63	470KΩ	½	23X20X474K	BTS-470K	
R64	10KΩ	½	23X20X103K	BTS-10K	
R65	470Ω	1	23X2047lK	BTA-470	
R66	4700Ω	½	23X20X472K	BTS-4700	
R67	47KΩ	2	23X40X473K	BTB-47K	
R68	22KΩ	1	23B088		Note 1
R69	22KΩ	1	23B088		Note 1
R70	470KΩ	½	23X20X474K	BTS-470K	
R71	390Ω	1	23X30X391K	BTA-390	
R72	47KΩ	2	23B087		Note 2
R73	470KΩ	½	23X20X474K	BTS-470K	
R74	47KΩ	2	23B087		Note 2
R75	100KΩ	½	23B086		Note 3

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: Hallicrafter PART No.	IRC PART No.	NOTES
R76	100KΩ	½	23B086		Note 3
R77	100Ω	1	23X30X101K	BTA-100	
R78	100Ω	1	23X30X101K	BTA-100	
R79	1000Ω	½	23X20X102K	BTS-1000	
R80	100Ω	½	23X20X102K	BTS-100	
R81	400Ω 2%	5	24BF401B		
R82	1000Ω	½	23X20X102K	BTS-1000	
R83	100Ω	½	23X20X101K	BTS-100	
R84	400Ω 2%	5	24BF401B		
R85	22KΩ	1	23X30X223K	BTA-22K	
R86	33KΩ	1	23X30X333K	BTA-33K	
R87	100KΩ	1	23X30X104K	BTA-100K	
R88	10KΩ	1	23X30X103K	BTA-10K	

Note 1. R68 and R69 must be matched within 2%.
Note 2. R72 and R74 must be matched within 2%.
Note 3. R75 and R76 must be matched within 2%.

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING: PRI.	RATING: SEC. 1	RATING: SEC. 2	RATING: SEC. 3	REPLACEMENT DATA: Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T2	117VAC @1.17A	870VCT @.137ADC	5VAC @3A	6.3VCT @3A						

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	REPLACEMENT DATA: Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	NOTES
T3	9.5KΩ	16Ω tap @ 8Ω	55D203B	A-8054 ①			H4102 ①	22S44 ①	① Drill new mounting holes.

FILTER CHOKE

ITEM No.	RATINGS: TOTAL DIRECT CURRENT	RATINGS: D.C. RESISTANCE	RATINGS: INDUCTANCE (0 CURRENT 1000 ∿)	REPLACEMENT DATA: Hallicrafters PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L18	.137A	167Ω	6.6HY	56C152	C-1421		C14A	C5025	20C54 ②
L19	.025A	788Ω	23.6HY	56C151	C-1003			C5003	

② Drill new mounting hole.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA: Hallicrafters PART No. FUSE	Hallicrafters PART No. HOLDER	LITTELFUSE PART No. FUSE	LITTELFUSE PART No. HOLDER	BUSS PART No. FUSE	BUSS PART No. HOLDER
M7	3AG	3A 250V	39A301	6A451	312003. (3AG-3A)	342001	AGC3	HKP

MISCELLANEOUS

ITEM No.	PART NAME	Hallicrafters PART No.	NOTES
M8	Switch	60A138	Amplifier off-on

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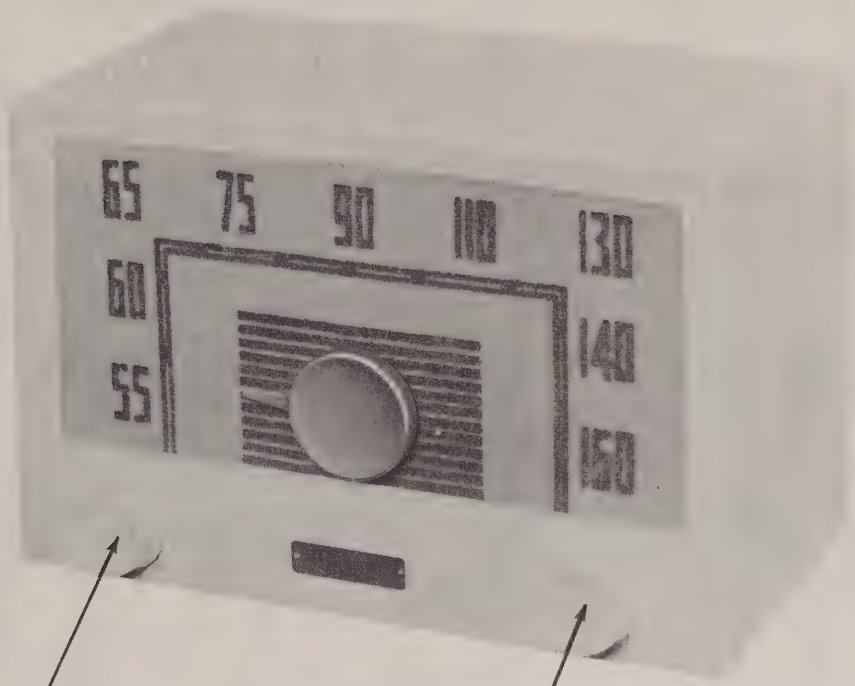
SONORA
MODELS 314, 315, 379, 441, 442, 477, 478



VOLUME CONTROL ON-OFF SWITCH

TUNING CONTROL

SONORA
MODELS 314, 315, 379, 441, 442, 477, 478

SONORA MODEL 379

TRADE NAME	Sonora Models 314, 315, 379, 441, 442, 477, 478
MANUFACTURER	Sonora Radio & Tel. Corp., 325 N. Hoyne Ave., Chicago, Ill.
TYPE SET	AC-DC Operated AM Superheterodyne Receiver
TUBES (Six)	Types 6C4 Osc., 12AU6 Mixer, 12BA6 IF Amp., 12AV6 Det.-AVC-AF Amp., 50C5 Audio Output, 35W4 Rectifier
POWER SUPPLY	105-120 Volts AC-DC RATING .22 Amp. @ 117 Volts AC
TUNING RANGE—BROADCAST	535-1620KC

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial. Use isolation transformer, if available. If not, connect a .1MFD capacitor in series with low side of signal generator and B-. Loop should be maintained in same relative position to chassis as when receiver is in cabinet. Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.05MFD	High side to antenna stator lug on tuning gang. Low side to B-.	455KC (400~Mod)	Tuning gang fully open	Across voice coil	A1, A2, A3, A4	Adjust for maximum output. If isolation transformer is not used, reduce dummy antenna to .001MFD to reduce hum modulation.
2.		Loop	1620KC	"	"	A5	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.
3.		"	1400KC	Tune to 1400KC signal	"	A6	"

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PARTS LIST AND DESCRIPTIONS

SONORA MODEL 314

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: SONORA PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	Oscillator	6C4	6C4	6BG	
V2	Mixer	12AU6	12AU6	7BK	
V3	IF Amplifier	12BA6	12BA6	7BK	
V4	Det. AVC AF Amp.	12AV6	12AV6	7BT	
V5	Audio Output	50C5	50C5	7CV	
V6	Rectifier	35W4	35W4	5BQ	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	SONORA PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	40	150	N-5051	PRS150/40-		BBRD4415		TCD48	TVA-2445	Blue
B	40	150		40						Red
C2	.05	200	N-1345	P288-05	DF-503	PJ2S5		PT415	2TM-S5	
C3	.05	200	N-1345	P288-05	DF-503	PJ2S5		PT415	2TM-S5	
C4	.01	400	N-1344	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C5	.05	200	N-1345	P288-05	DF-503	PJ2S5		PT415	2TM-S5	
C6	100		N-6015	S1100	D6-101	TP34	GP1K-101	UC-531	5GA-T1	
C7	.005	600	N-4894	P688-005	D6-502	CUB6D5	801-005	PT625	6TM-D5	
C8	250		N-6488	S1250	D6-251	TP40	GP2K-251	UC-5325	5GA-T25	
C9	.01	400	N-1344	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C10	.02	400	N-1376	P488-02		CUB4S2		PT412	4TM-S2	
C11	.05	400	N-1346	489ZX-05	DF-503	PJ4S5		PT415	4TM-S5	
C12	.08	200	N-8092							

♦ Models 477 and 478 use an audio couplate in place of C12, C13, R8 and R9 (Sonora part #N-3215.)

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	SONORA PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500KΩ	½	N-7984	Q13-133	A47-500K-2	BSK-60-S	U-48	Volume 50KΩ stop-Note
B	Shaft		Not Req.	Not Req.	KSS-3	Not Req.	Not Req.	Attach to R1A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R1A

Note: Connect a 50KΩ resistor in series with the right hand terminal of the control and the lead connecting to the original control.

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	SONORA PART No.	IRC PART No.	NOTES
R2	3.3Meg	½	N-4062	BTS-3.3Meg	
R3	47KΩ	½	N-4063	BTS-47K	
R4	68Ω	½	N-6485	BTS-68	
R5	47KΩ	½	N-4063	BTS-47K	
R6	1 Meg	½	N-1262	BTS-1 Meg	
R7	6.8Meg	½	N-4028	BTS-6.8Meg	

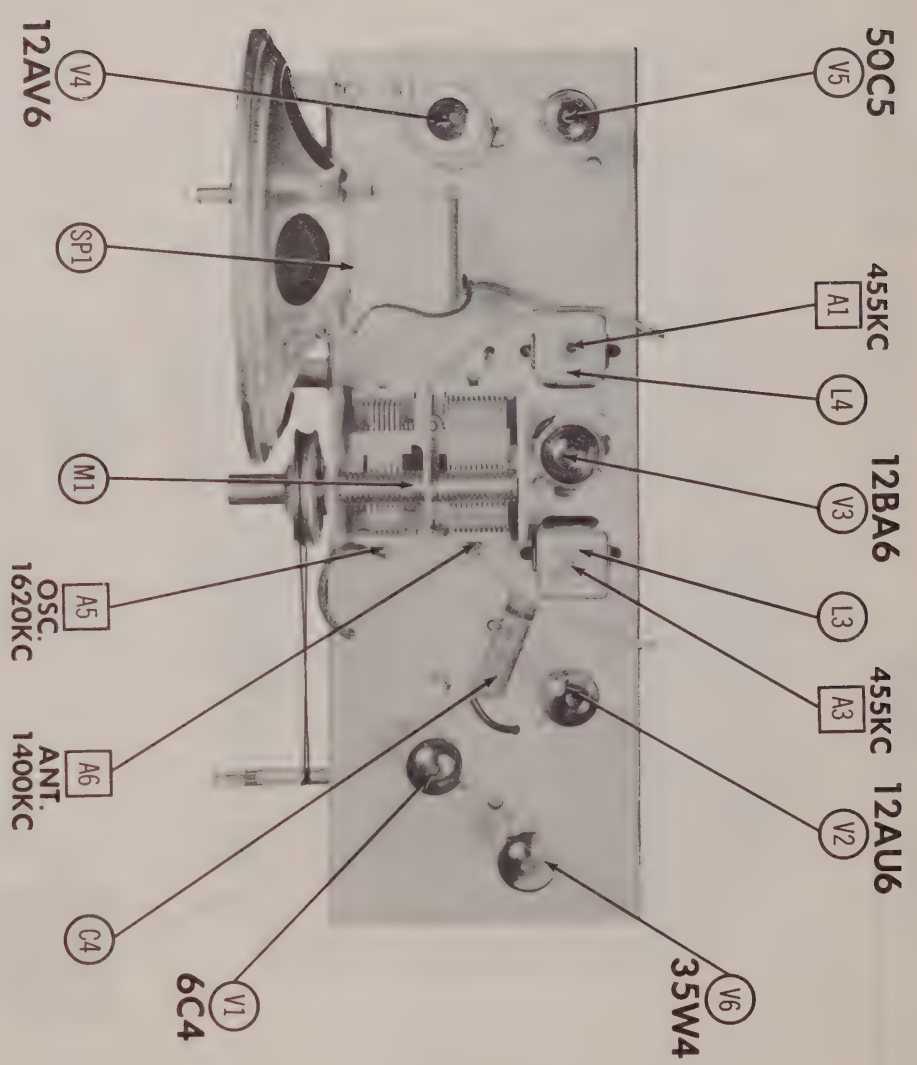
ITEM No.	RATING: OHMS	RATING: WATT	SONORA PART No.	IRC PART No.	NOTES
R8	220KΩ	½	N-4026	BTS-220K	
R9	470KΩ	½	N-4027	BTS-470K	
R10	180Ω	½	N-4067	BTS-180	
R11	1000Ω	½	N-3341	BTS-1000	
R12	22Ω	1			Note

Note: Not used in all models.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	SONORA PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	NOTES
T1	2.3KΩ	3.4Ω	N-8001 ①	A-3336	A-3031		Z1102	TS-24S50	① Trans. has 5Ω tap on primary.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA SONORA PART No.	REPLACEMENT DATA MEISSNER PART No.	REPLACEMENT DATA MERIT PART No.	REPLACEMENT DATA MILLER PART No.	NOTES
L1	Loop Ant.	.2Ω	2.1Ω	N-8002			69-Osc. †	Pri. tapped @ .2Ω
L2	Osc. Coil	4.8Ω	7Ω	N-7982				
L3	Input IF	.7Ω	15Ω	N-7981	16-6758	BC-352	12-C1	
L4	Output IF	13Ω	13Ω	N-7981	16-6758	BC-353	12-C2	

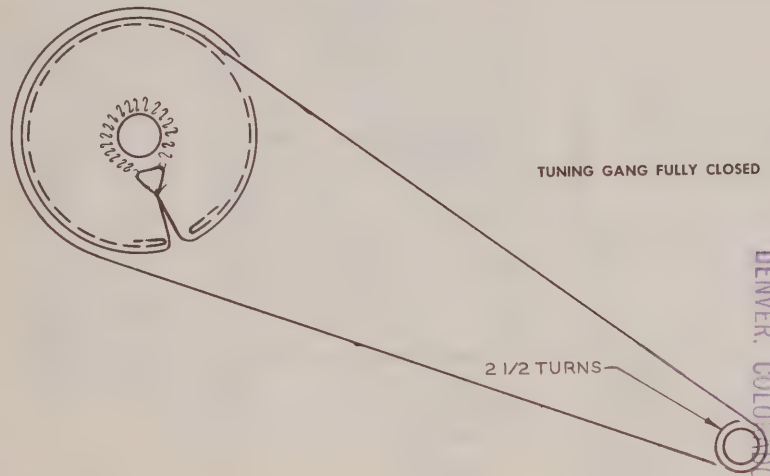
† Drill mounting hole.

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V. C. IMP.	REPLACEMENT DATA SONORA PART No.	REPLACEMENT DATA JENSEN PART No.	REPLACEMENT DATA QUAM PART No.	NOTES
SP1	5"	PM	3.4Ω	N-7980 N-7981 ①	ST-105 Mod. P5-X	5A1	① Alternate PM speaker

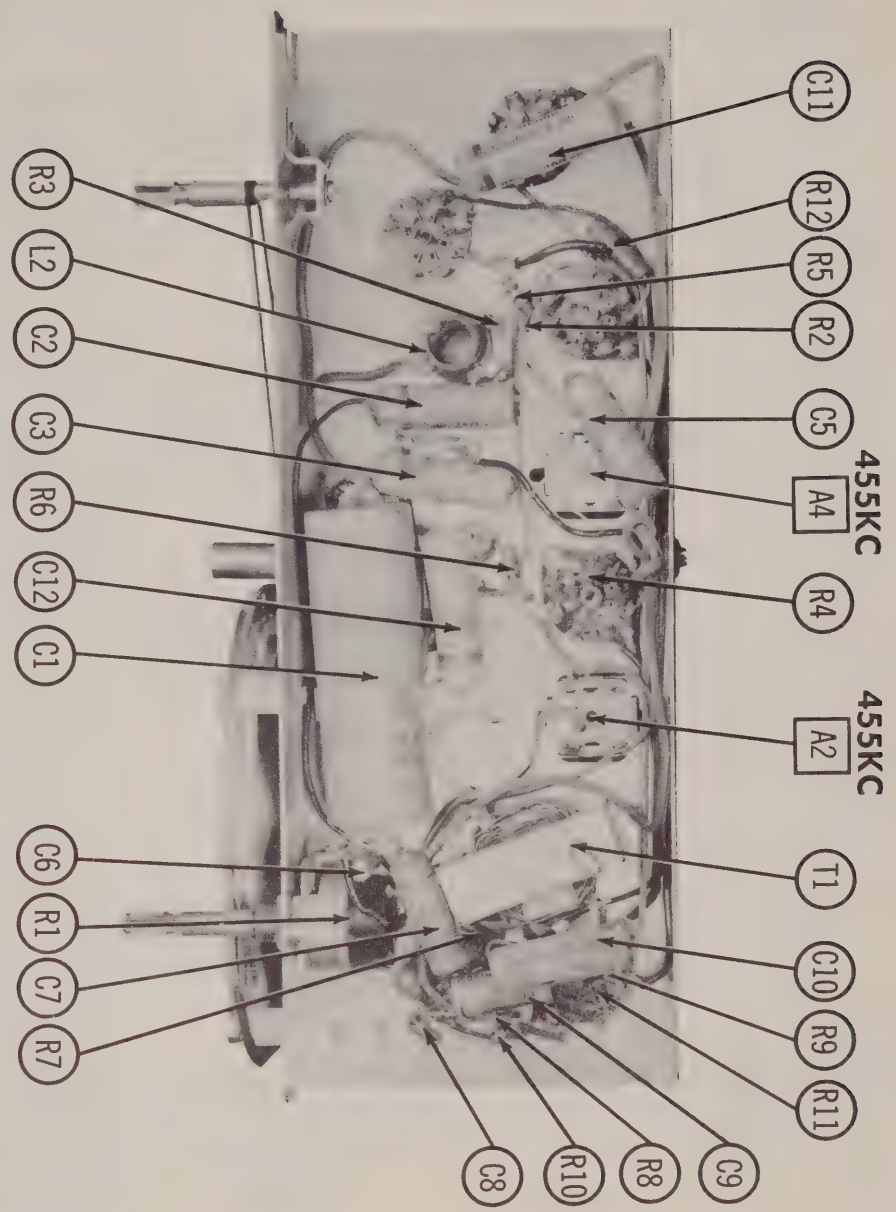
MISCELLANEOUS

ITEM No.	PART NAME	SONORA PART No.	NOTES
M1	Tuning Cap.	N-7983	(17-370MMF, 19-127MMF)
	Cabinet	314	Model 314
	Cabinet	315	Model 315
	Cabinet	379	Model 379
	Cabinet	441	Model 441
	Cabinet	442	Model 442
	Cabinet	477	Model 477
	Cabinet	478	Model 478
	Knob	N-8003	Ivory - 2 used
	Knob	N-8004	Walnut - 2 used
	Screen	N-8005	Flocked dial



DRIVE CORD STRINGING

CHASSIS—BOTTOM VIEW



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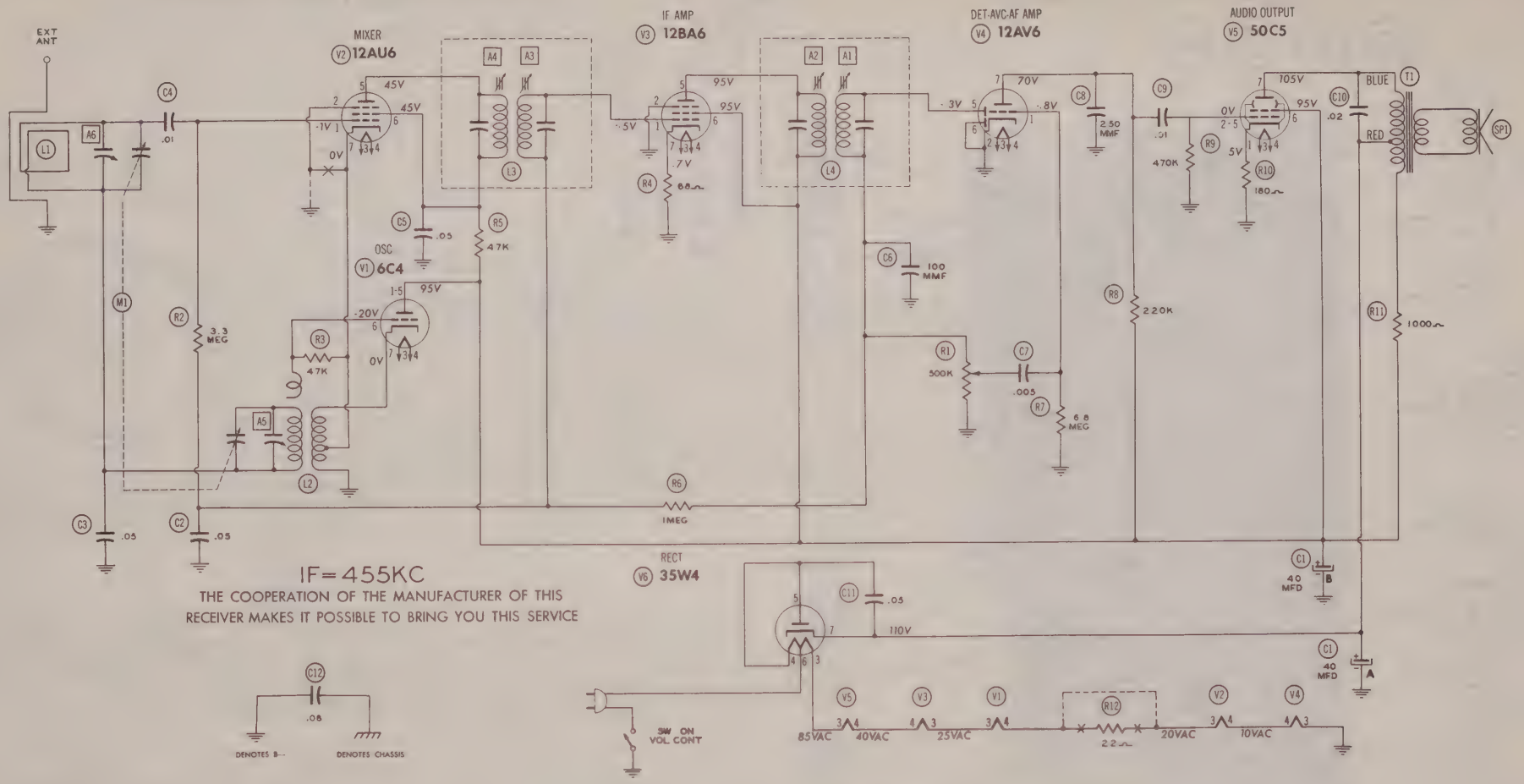

IF=455KC

THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V-1	6C4	↑1KΩ	INF	55Ω	49Ω	↑1KΩ	47KΩ	6Ω
V-2	12AU6	4.8Meg	.3Ω	25Ω	14Ω	↑48KΩ	↑48Ω	.3Ω
V-3	12BA6	1.5Meg	0Ω	55Ω	68Ω	↑1KΩ	↑1KΩ	68Ω
V-4	12AV6	4.8Meg	0Ω	0Ω	14Ω	500KΩ	0Ω	↑220KΩ
V-5	50C5	180Ω	470KΩ	120Ω	68Ω	470KΩ	↑1KΩ	↑235Ω
V-6	35W4	INF	INF	130Ω	155Ω	155Ω	150Ω	100KΩ

↑ MEASURED FROM PIN 7 OF V5

1. DC voltage measurements taken with vacuum tube voltmeter, AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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SUPPLEMENTAL DATA TO PHOTOFACT FOLDER 8 IN SET 237

Motorola Chassis TS-402, Y, TS-502, Y, TTS-502, Y, VTS-402, Y, VTS-502, Y and WTS-502, Y are covered in Photofact Folder 8, Set 237. Several new models and chassis were later added to this series. A list of all the models, with the chassis used in each, is given below.

MODEL	CHASSIS	MODEL	CHASSIS
Y17K17, A, AB, B	TS-402Y	17K17, A, AB, B	TS-402
Y17T15A, AE	VTS-402Y	17T15A, AE	VTS-402
Y17T16, B, W	TS-402Y	17T16, B, W	TS-402
Y21C2	TS-502Y	21C2	TS-502
Y21C2A, AB	WTS-502Y	21C2A, AB	WTS-502
Y21C2B	TS-502Y	21C2B	TS-502
Y21F5, B	TS-502Y, QTS-502Y	21F5, B	TS-502, QTS-502
Y21K12A, AB, AW, C, CB, CW, D, DB, DW	WTS-502Y	21K12A, AB, AW, C, CB, CW, D, DB, DW	WTS-502
Y21K12G	RTS-502Y	21K12G	RTS-502
Y21K13	TS-502Y	21K13	TS-502
Y21K13A, AB	RTS-502Y	21K13A, AB	RTS-502
Y21K13B	TS-502Y	21K13B	TS-502
Y21K14	TS-502Y, QTS-502Y	21K14	TS-502, QTS-502
Y21K14A, AB	RTS-502Y	21K14A, AB	RTS-502
Y21K14B, Y21K15	TS-502Y, QTS-502Y	21K14B, 21K15	TS-502, QTS-502
Y21K15A	RTS-502Y	21K15A	RTS-502
Y21K16	TS-502Y, QTS-502Y	21K16	TS-502, QTS-502
Y21K16AB, AW	RTS-502Y	21K16AB, AW	RTS-502
Y21K16W	TS-502Y, QTS-502Y	21K16W	TS-502, QTS-502
Y21K17	TS-502Y	21K17	TS-502
Y21K17A	WTS-502Y	21K17A	WTS-502
Y21K18, B	PTS-502Y	21K18, B	PTS-502
Y21T8A, AE	TTS-502Y	21T8A, AE	TTS-502
Y21T10	VTS-505Y	21T10	VTS-505
Y21T11, B, W	VTS-502Y	21T11, B, W	VTS-502
Y21T13, B	TS-524Y	21T13, B	TS-524
Y21T14E	TS-507Y	21T14E	TS-507

All of the above chassis are basically alike, except for changes in shaft length of controls, control location, picture tubes, etc. , A list of the differences between the chassis is given below.

Ch. TS-402

Ch. TS-402 is the basic chassis for this series and uses a 17LP4 picture tube. The controls listed in Photofact Folder 8, Set 237, are for Ch. VTS-402. A list of the controls used in Ch. TS-402 is given below. The two sets of controls are identical except for shaft length.

ITEM NO.	PART NO.	FUNCTION
R2	18B730149	On/off, Volume & Contrast
R3	18A730143	Brightness
R4	18A730220	Vert. Size
R5	18A730147 or 18A731621	Horiz. Hold
R6	18A730218	Vert. Linearity
R7	18A730145	Vert. Hold

Ch. VTS-402

Ch. VTS-402 is identical to chassis TS-402, except for the different shaft length of controls. The controls listed in Photofact Folder 8, Set 237, are the correct controls for Ch. VTS-402.

Ch. TS-502

Chassis TS-502 is identical to chassis TS-402, except a 21FP4A picture is used. The filament transformer (part #25B730139) is connected as shown in the upper alternate circuit given on the schematic in Photofact Folder 8, Set 237. Chassis TS-502 uses the 24K732746 or 24K732747 horizontal output transformer.

MOTOROLA CHASSIS HS-409, PTS-502, Y, QTS-502, Y, RTS-502, Y, TTS-502, Y, TS-402, Y, TS-502, Y, TS-507, Y, TS-524, Y, VTS-402, Y, VTS-502, Y, VTS-505, Y, WTS-502, Y

PROPERTY O
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AND
DEL

PRODUCTION CHANGES
BULLETIN 106

PRODUCTION CHANGES
BULLETIN 106

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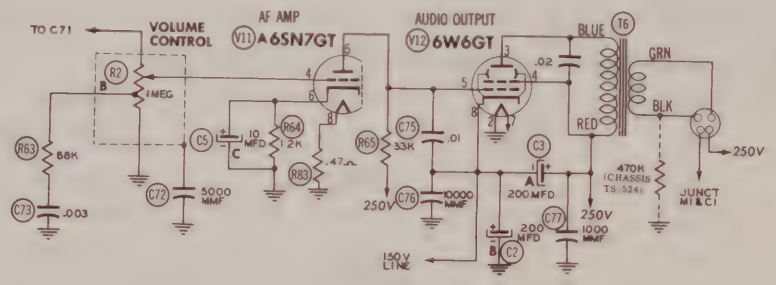
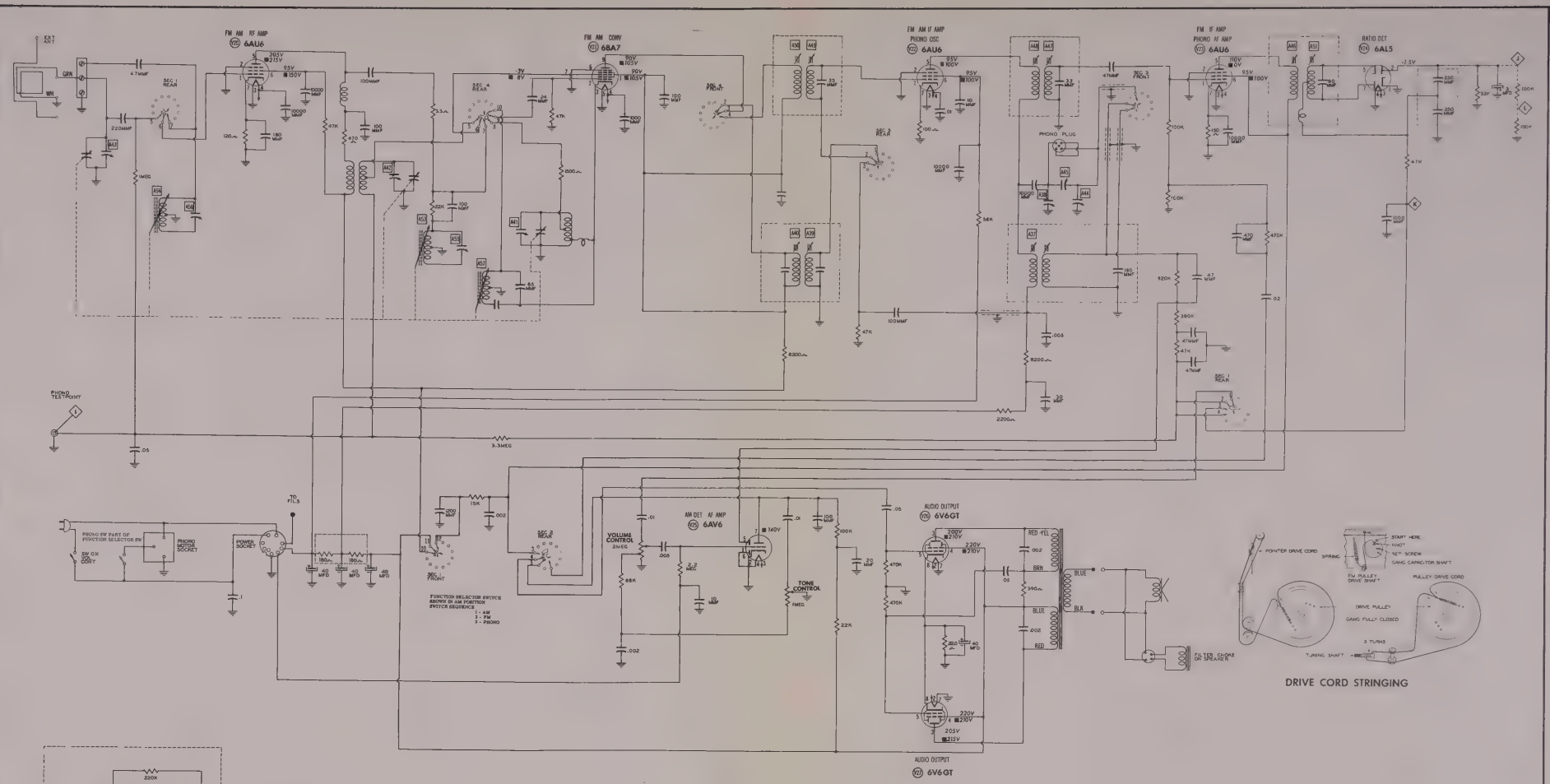
Ch. PTS-502	Chassis PTS-502 is identical to Ch. TS-502, except for the following: A 21YP4 picture tube is used in Ch. PTS-502. The vertical linearity and vertical size controls were moved to a point near the filament transformer on the rear of the chassis. The part number for the new vertical linearity control is 18A702475, and the part number for the new vertical size control is 18A702443 . The brightness and vertical hold controls were also changed to part number 18K732775 and 18A732780, respectively. A 470KΩ resistor was added from the secondary (black lead) of the audio output transformer (T6) to ground in order to prevent a static charge from appearing on the metal bezel.
Ch. QTS-502	Ch. QTS-502 is identical to Ch. TS-502, except a 21FP4C picture tube is used.
Ch. RTS-502	Ch. RTS-502 is identical to Ch. TS-502, except a 21YP4A picture tube is used and the picture tube is not tilted.
Ch. TTS-502	Ch. TTS-502 is identical to Ch. TS-502, except for the length of control shafts. Ch. TTS-502 uses the same set of controls as Ch. VTS-402, which are listed in the parts list in Photofact Folder 8, Set 237.
Ch. VTS-502	Ch. VTS-502 is identical to Ch. TS-502, except a 21YP4 picture tube is used and a 470KΩ resistor was added from the black lead of the audio output transformer to ground in order to prevent a static charge from building up on the metal cabinet.
Ch. WTS-502	Ch. WTS-502 is identical to Ch. TS-502, except a 21YP4 picture tube is used.
Ch. VTS-505	Ch. VTS-505 is identical to Ch. TS-502, except a 21MP4 picture tube is used. When the 21MP4 picture is used, the ion trap is changed to part number 24A702047, the horizontal output transformer is changed to part number 24K732747 or 24K730903, and a 500MMF, high voltage filter capacitor, is added from pin 7 of the high voltage rectifier (V18) to ground.
Ch. TS-507	Ch. TS-507 is identical to Ch. TS-502, except a 21XP4 picture tube is used and the picture tube tilt is eliminated. The dial light (M6) and R108 were omitted. The tone control (R2) and C74 were omitted. A .02MFD capacitor was added across the primary of the audio output transformer (T6) and C75 was changed from .005MFD to .01MFD. A partial schematic showing the revised audio circuit is given below. 
Ch. TS-524	Ch. TS-524 is identical to Ch. TS-507, except for the following: A 21YP4 picture tube is used and the picture tube tilt is eliminated. A 470KΩ resistor is added, from the black lead of T6 to ground, as shown in the dotted lines in the partial schematic above. The vertical linearity and vertical size controls were moved to a point near the filament transformer on the rear of the chassis. The part number for the new vertical linearity control is 18A702475 and the vertical size control is 18A702443. The brightness, vertical hold and horizontal hold controls were retained on the front of the chassis; however, the brightness control was changed to part number 18K732775 and the vertical hold control was changed to part number 18A732780. These controls are identical to the parts originally used, except for shaft length.
Chassis With "Y" Suffix	Chassis with the "Y" suffix contain a built-in UHF tuner. The TT-37 or WTT-37 UHF tuner is used in all of the chassis in this series.
Models Y21F5, B 21F5, B	Models Y21F5, B and 21F5, B also include an AM-FM radio chassis (HS-409). A schematic of this radio is given on pages 3 and 4. Alignment instructions are given on page 5.



DRIVE CORD STRINGING

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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253-1

ALIGNMENT INSTRUCTIONS

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ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial. Record Changer must be connected to the receiver during alignment.

AM ALIGNMENT

Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output. Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
24.	.1MFD	High side to pin 7 (grid) of 6BA7 (V21). Low side to chassis.	455KC (400~Mod)	AM	Tuning gang fully open	Across voice coil	A37,A38 A39,A40	Adjust for maximum output.
25.	"	"	1620KC	"	"	"	A41	"
26.	"	High side to pin 1 (grid) of 6AU6 (V20). Low side to chassis.	1400KC	"	Tune to 1400KC signal	"	A42	"
27.		Loop	"	"	"	"	A43	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.

PHONO ALIGNMENT

Set bandswitch to phono position. Connect VTVM, high side to point ⓘ, low side to chassis. Adjust A44 for maximum reading on VTVM. Adjust A45 for -11.5 volts on VTVM. NOTE: This reading may be obtained at two settings of A45; use the reading with trimmer set at highest capacity (clockwise direction).

FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Connect two matched 100KΩ (±1%) resistors from point ⓙ to chassis. The junction of these two resistors is alignment point ⓘ as shown on the schematic.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
28.	.001MFD	High side to pin 1 (grid) of 6AU6 (V22). Low side to chassis.	10.7MC (Unmod)	FM	Tuning gang fully open	DC probe to point ⓙ. Common to chassis.	A46,A47 A48	Adjust for maximum deflection. Attenuate generator to maintain 5 volts or less reading.
29.	"	High side to pin 7 (grid) of 6BA7 (V21). Low side to chassis.	"	"	"	"	A49 A50	"
30.	"	"	"	"	"	DC probe to point ⓚ. Common to point ⓘ.	A51	Adjust for zero reading. A positive and negative reading will be obtained on either side of correct setting.

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60~ modulation and 450KC sweep. Use 120~ sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
31.	.001MFD	High side to pin 1 (grid) of 6AU6 (V22). Low side to chassis.	10.7MC (450KC Swp)	FM	Tuning gang fully open	Vert. Amp. to point ⓙ. Low side to chassis.	A46 A47 A48	Disconnect 3MFD stabilizer capacitor. Adjust for maximum amplitude and symmetry as in Fig. 11.
32.	"	High side to pin 7 (grid) of 6BA7 (V21). Low side to chassis.	"	"	"	"	A49 A50	"
33.	"	"	"	"	"	Vert. Amp. to point ⓚ. Low side to chassis.	A51	Reconnect 3MFD stabilizer capacitor. Adjust so that 10.7MC occurs at center of crossover lines as in Fig. 12. SLIGHTLY retouch A46 for maximum amplitude and straightness of cross-over lines.

FM RF ALIGNMENT

Before performing step 35, preset A55 and A56 by turning each adjustment counter clockwise until the cores are at bottom of the pipes, then turn two turns clockwise.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
34.	270Ω Carbon Resistors	High side thru 270Ω to FM antenna terminal. Low side to chassis.	105MC (Unmod)	FM	105MC	DC probe to point ⓙ. Common to chassis.	A52	Adjust for maximum deflection.
35.	"	"	90MC	"	Tune to 90MC signal	"	A53 A54	"
36.	"	"	105MC	"	Tune to 105MC signal	"	A55 A56	"

Repeat steps 35 and 36 until no further improvement can be made.

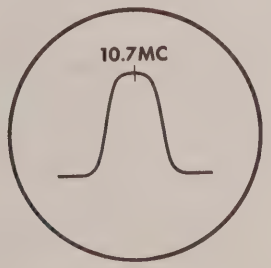


FIG. 11

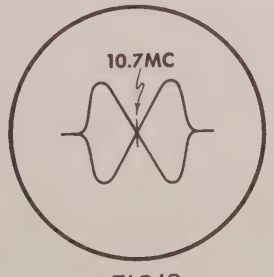
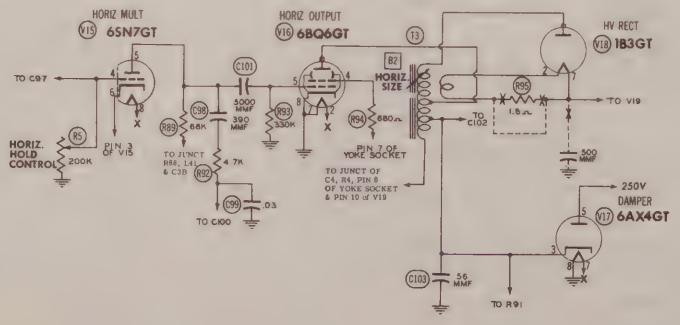


FIG. 12

MOTOROLA CHASSIS HS-408, PTS-502, Y, QTS-502, Y, RTS-502, Y, TTS-502, Y, TS-402, Y, TS-502, Y, TS-507, Y, TS-524, Y, VTS-402, Y, VTS-502, Y, VTS-505, Y, WTS-502, Y

	In later production of these chassis numerous production changes were made. Production changes in Motorola Television receivers are coded by the following method. First production of a chassis are coded with the suffix "A-00" added to the chassis number, e.g., Ch. TS-402A-00 or TS-402AY-00. When the first minor electrical revision is made the suffix is changed to "A-01" and the next "A-02", etc. When the first major change is made the suffix is changed to "B-00". When a minor change is then made the coding is changed to "B-01", etc. as before. Mechanical changes made in the chassis are coded by adding a prefix letter to the chassis number, e.g., Ch. RTS-502, TTS-502. These letters are picked at random , but will occur near the end of the alphabet. Production changes thru Code "A-04" are included in Photofact Folder 8, Set 237. Later production changes are given below.
Ch. coded "A-05"	TO PROVIDE A VARIABLE FOCUS ADJUSTMENT A shunting strap (part #42A731567) was added from pin 6 of the picture tube (V19) to either pin 2 or pin 10 of the picture tube. When this strap is used the lead formerly connected to the 150V line is omitted.
Ch. coded "A-06"	TO REDUCE 39.75MC INTERFERENCE A 39.75MC trap and a 56MMF capacitor were added across L23. The part number for the new coil is 24B732260. This includes the 39.75MC trap and the first video IF coil (L23). TO REDUCE HORIZONTAL PULL IN LOCAL AND SUBURBAN POSITIONS OF AREA SELECTOR SWITCH R46 (pin 2 of V7) was removed from ground and a 5.6KΩ resistor was added in series with R46 to ground . A 180KΩ resistor is then added from the junction of R46 and the 56KΩ resistor to the area selector switch side of R39.
Ch. coded "B-00"	NEW VHF TUNER The VHF tuner was changed to one using an all metal fine tuning shaft, and a new type channel selector switch is used. When this change is made the fine tuning control is removed from ground and three 1500MMF capacitors, connected in parallel, were added from the bottom of the fine tuning control to ground. The VHF tuners incorporating these changes are coded TT-53A (part number 1U731901), TT-53AY (part number 1U731903), TT-61A (part number 1U731902) and TT-61AY (part number 1U731905). Some chassis used the WTT-53, WTT-53Y, WTT-61 and WTT-61Y VHF tuners. These tuners have the all metal fine tuning shaft , but have a reworked old style channel selector switch. For replacement purposes use the TT-53A, TT-53AY, TT-61A or TT-61AY tuners.
Ch. coded "B-01"	NEW HORIZONTAL OUTPUT TRANSFORMER The horizontal output transformer was changed to part number 24K732746 for Ch. TS-502 and to part number 24K732747 for Ch. TS-505. When this change was made the following changes were made in components, to speed retrace, improve horizontal linearity, and to increase high voltage. The horizontal hold control (R5) was changed to 200KΩ, with a 50KΩ stop (part number 18A731621). R89 was changed from 100KΩ to 68KΩ. C98 was changed from 680MMF to 390MMF. R92 was changed from 6.8KΩ to 4.7KΩ. R94 was changed from 470Ω to 680Ω. C103 was changed from 180MMF to 56MMF. A partial schematic showing the revised circuit is given below. 

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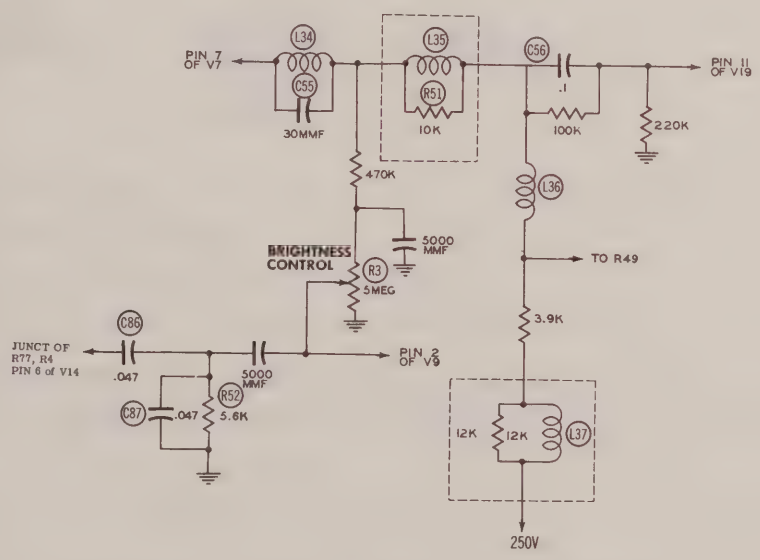
Ch. coded "B -02"	TO PREVENT ARC-OVER IN THE PICTURE TUBE A 5000MMF, 2000V, capacitor (part number 21R120093) was added between the control grid (pin 2) of the picture tube (V19) and ground.
Ch. coded "B-03"	TO REDUCE RADIATION OF VIDEO INFORMATION TO HORIZONTAL HOLD CONTROL A 5000MMF bypass capacitor was added between the center terminal of the brightness control (R3) and ground.
Ch. coded "B-04"	Chassis coded "B-04" are identical to chassis coded "B-03", except in a few chassis the horizontal hold control was changed to 112.5KΩ (part number 18A730147) and an 82KΩ resistor was used in series with the control to ground. For replacement purposes use the 200KΩ control (Code "B-01").
Ch. coded "B-05"	TO INCREASE SENSITIVITY ON HIGH CHANNELS C24 (pin 7 of V2) was changed from a 470MMF, feed-thru type, to a 470MMF, ceramic disc type, capacitor. When this change was made the tuner coding was changed to TT-53B, TT-53BY, TT-61B and TT-61BY.
Ch. coded "B-06"	TO IMPROVE THE CONTRAST TO BRIGHTNESS RATIO The following changes were made in chassis coded " B-06". R53 was omitted. R52 was changed from 3.3KΩ to 5.6KΩ. A 470KΩ resistor was added from the junction of L34 and L35 to the high side of the brightness control (R3) and a 5000MMF capacitor was added from the junction of this resistor, and the brightness control, to ground. The high side of the brightness control was removed the 150V line. The grid (pin 2) of the picture tube (V19) was connected to the center terminal of the brightness control. A 5000MMF, 2000V, capacitor was added between the center terminal of the brightness control and the junction of C86, C87 and R52. R51 was connected in parallel with C56 and a 220KΩ resistor was added from the cathode (pin 11) of the picture tube to ground. A partial schematic is given below which shows the revised circuit. 
Ch. coded "B-07"	TO ELIMINATE STATIC CHARGE ON METAL BEZEL The 470KΩ resistor which was added from the secondary (black lead) of the audio output transformer to ground in Ch. PTS-502 was changed to 2.2Meg.
Ch. coded "B-08"	TO INCREASE HORIZONTAL SWEEP C103 was changed from 56MMF (code "B-01") to 100MMF.

Ch. coded "B-09"	Chassis coded "B-09" are identical to chassis coded "B-08", except in a few chassis R49 was changed to 10KΩ and R50 and C78 were added as shown in the dotted lines in the schematic in Photofact Folder 8, Set 237.
Ch. coded "C-00"	VHF TUNER REVISED The VHF tuner rear plate, mounting bracket, and sprocket bushing were changed so they could be used in conjunction with a belt driven UHF tuner. The front sprocket continues to use the bead chain drive. The VHF tuner incorporating these changes are coded WTT-53B (part number 1U732868), WTT-53BY (part number 1U732986), WTT-61B (part number 1U732873) and WTT-61BY (part number 1U732897).
Ch. coded "C-01"	TO ELIMINATE RINGING A choke was added between terminal 3 of the horizontal output transformer and the cathode (pin 3) of V17 and another choke was added between the plate (Pin 5) of V17 and 250V.
Ch. coded "C-02"	TO PREVENT VIDEO OSCILLATION L33 was changed to a coil wound on an 8.2KΩ resistor (part number 24R121728).

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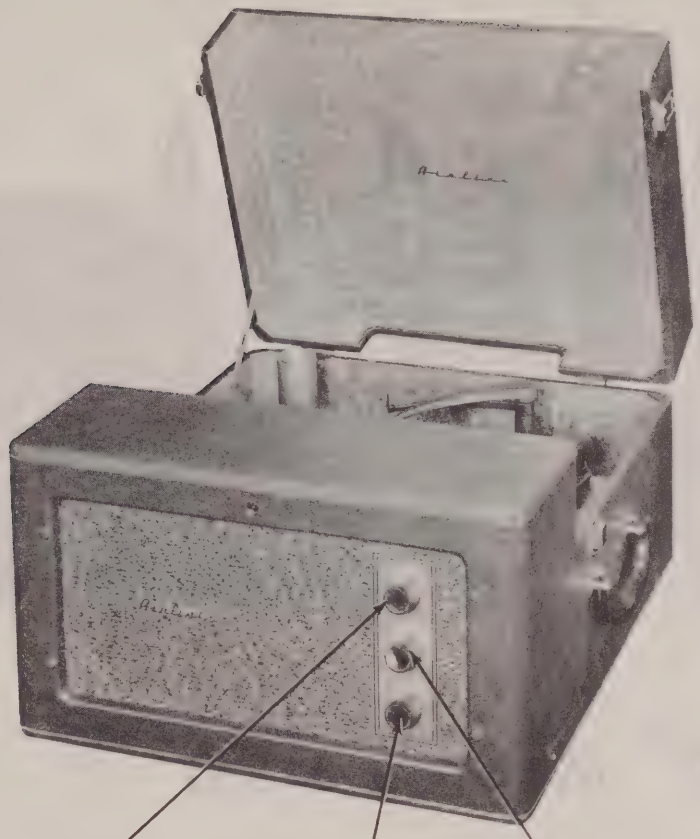
AIRLINE
MODEL 35GAA-970A



AIRLINE
MODEL 35GAA-970A

TRADE NAME	Airline Model 35GAA-970A
SUPPLIER	Montgomery Ward & Co., 619 Chicago Ave., Chicago, Ill.
TYPE SET	AC Operated Phono Amplifier With 3 Speed Automatic Record Changer
TUBES (Five)	Types 12AT7 Cath. Follower -AF Amp., 12AX7 Phase Inv., (2) 6V6GT Audio Output, 5Y3GT Rectifier
POWER SUPPLY	110-115 Volts AC-60 Cycles RATING .48 Amp. @ 117 Volts AC

RECORD CHANGER UNIT - WEBSTER-CHICAGO MODEL 114

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PARTS LIST AND DESCRIPTIONS

AIRLINE
MODEL 35GAA-970A

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		AIRLINE PART No.	STANDARD REPLACEMENT		
V1.	Cathode Follower-AF Amplifier	12AT7	12AT7	9A	
V2	Phase Inverter	12AX7	12AX7	9A	
V3	Audio Output	6V6GT	6V6GT	7S	
V4	Audio Output	6V6GT	6V6GT	7S	
V5	Rectifier	5Y3GT	5Y3GT	5T	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	AIRLINE PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C1A	▰20	450	1006	AFH4-14		D013		FP444	TVL-4763	
B	■20	450								
C	▲20	350								
D	10	350						PT415	4TM-S5	
C2	.05	400		P488-05	DF-503	CUB4S5		DC-525	5HK-D5	
C3	5000			BPD-005	DD-502	K080	801-005	MC245	1FM-35	
C4	470	500	809-A	1469-0005		5R5T47		MC245	1FM-35	
C5	470	500	809-A	1469-0005		5R5T47		PT415	4TM-S5	Note 1
C6	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	Note 1
C7	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	Note 1
C8	.05	400		P488-05	DF-503	CUB4S5		DC-511	5HK-S1	Note 2
C9	10000			BPD-01	DD-103	K082	811-01			

Note 1. Some models use .02MFD in this application.
Note 2. Not used in all models.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	AIRLINE PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	500KΩ	½	H9039	Q13-133	A47-500K-Z	BSK-60-S	U-48	Volume
B	Shaft		Not Req.	Not Req.	KSS-3	Not Req.	Not Req.	Attach to R1A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R1A
R2A	500KΩ	½	R3027	Q13-133	A47-500K-Z	BSK-60	U-48	Bass
B	Shaft		Not Req.	Not Req.	KSS-3	Not Req.	Not Req.	Attach to R2A
R3A	500KΩ	½	R3027	Q13-133	A47-500K-Z	BSK-60	U-48	Treble
B	Shaft		Not Req.	Not Req.	KSS-3	Not Req.	Not Req.	Attach to R3A

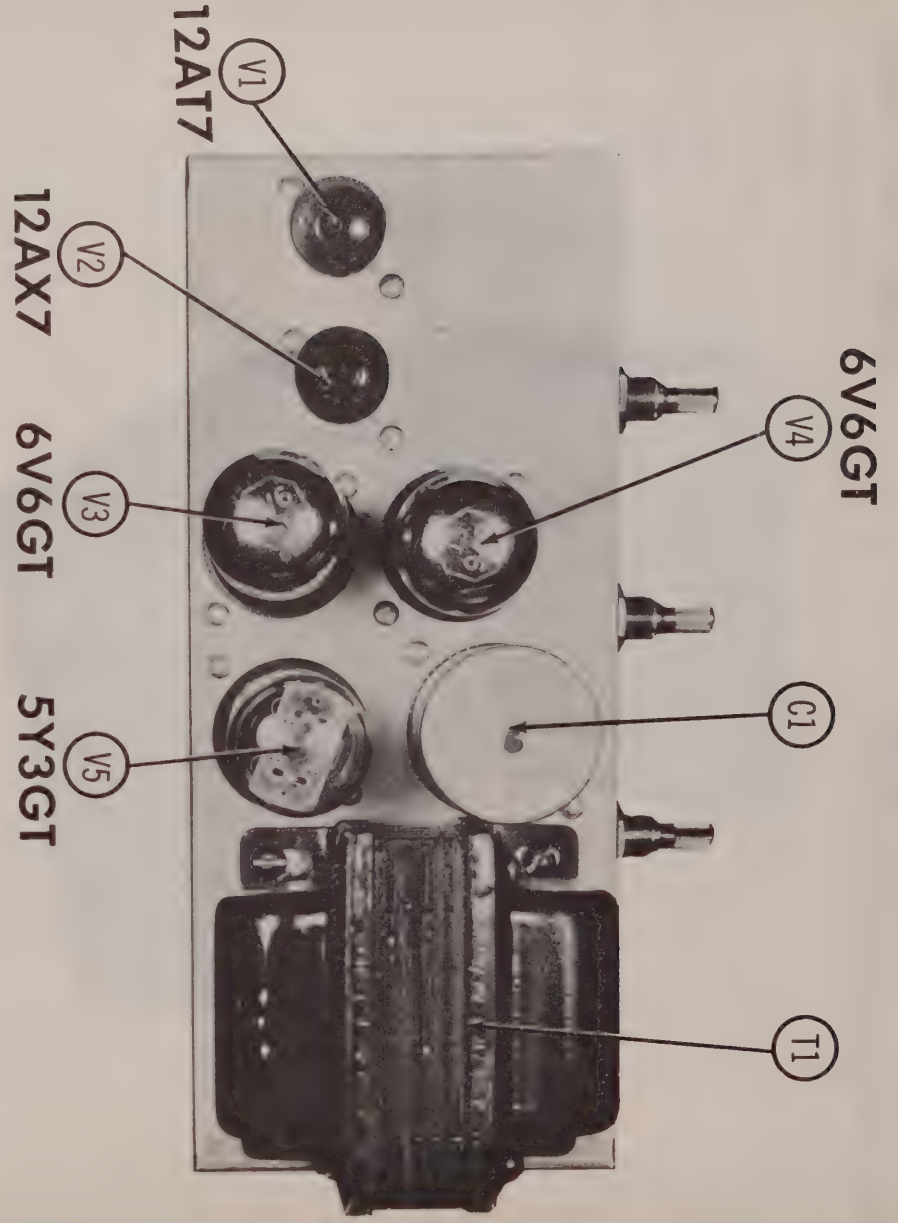
RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	AIRLINE PART No.	IRC PART No.	
R4	1 Meg	½		BTS - 1 Meg	
R5	10KΩ	½		BTS-10K	
R6	250KΩ	½		BTS-250K	Note 1
R7	22KΩ	½		BTS-22K	
R8	2200Ω	½		BTS-2200	
R9	100KΩ	½		BTS-100K	
R10	47KΩ	½		BTS-47K	Note 2
R11	50Ω	½			Note 3
R12	100KΩ	½		BTS-100K	
R13	1000Ω	½		BTS-1000	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	AIRLINE PART No.	IRC PART No.	
R14	100KΩ	½		BTS-100K	
R15	500 KΩ	½			Note 4
R16	47KΩ	½		BTS-47K	Note 5
R17	200Ω	5	604	1 3/4A-200	
R18	500KΩ	½			Note 4
R19	10KΩ	½		BTS-10K	
R20	470Ω	1		BTA-470	
R21	10KΩ	½		BTS-10K	
R22	10KΩ	½		BTS-10K	

Note 1. Some models may use a 270KΩ resistor in this application.
Note 2. Some models may use a 1000Ω resistor in this application.
Note 3. Some models may use a 47Ω resistor in this application.
Note 4. Some models may use a 470KΩ resistor in this application.
Note 5. Some models may use a 15KΩ resistor in this application.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	AIRLINE PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @.48A	510VCT .077ADC	5VAC @2A	6.3VCT @2A	1104	PC-8404		R-10A ①	P9206	

① Drill new mounting holes.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.1	AIRLINE PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	
T2	10KΩ CT	8Ω SEC.2 500Ω	1205						Sec.#2 Feedback windings.

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA			NOTES
	SIZE	FIELD	V. C. IMP.	AIRLINE PART No.	JENSEN PART No.	QUAM PART No.	
SP1	8"	PM	8Ω	2069 2613 ①	ST-104 Mod. P8-S	8A4	① Alternate 8" speaker

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA						REMARKS
	AIRLINE PART No.	ASTATIC PART No.		SHURE PART No.		ELECTRO-VOICE PART No.		
		CARTRIDGE	NEEDLE	CARTRIDGE	NEEDLE	CARTRIDGE	NEEDLE	
M1	60-38	CAC-D-J	"Q" Q-33			46T		

ASTATIC NEEDLE LISTINGS SHOWN ABOVE ARE SPECIFIED FOR THE RESPECTIVE REPLACEMENT CARTRIDGE LISTED. FOR ORIGINAL CARTRIDGE NEEDLE REPLACEMENT SEE BELOW.

PHONO NEEDLE

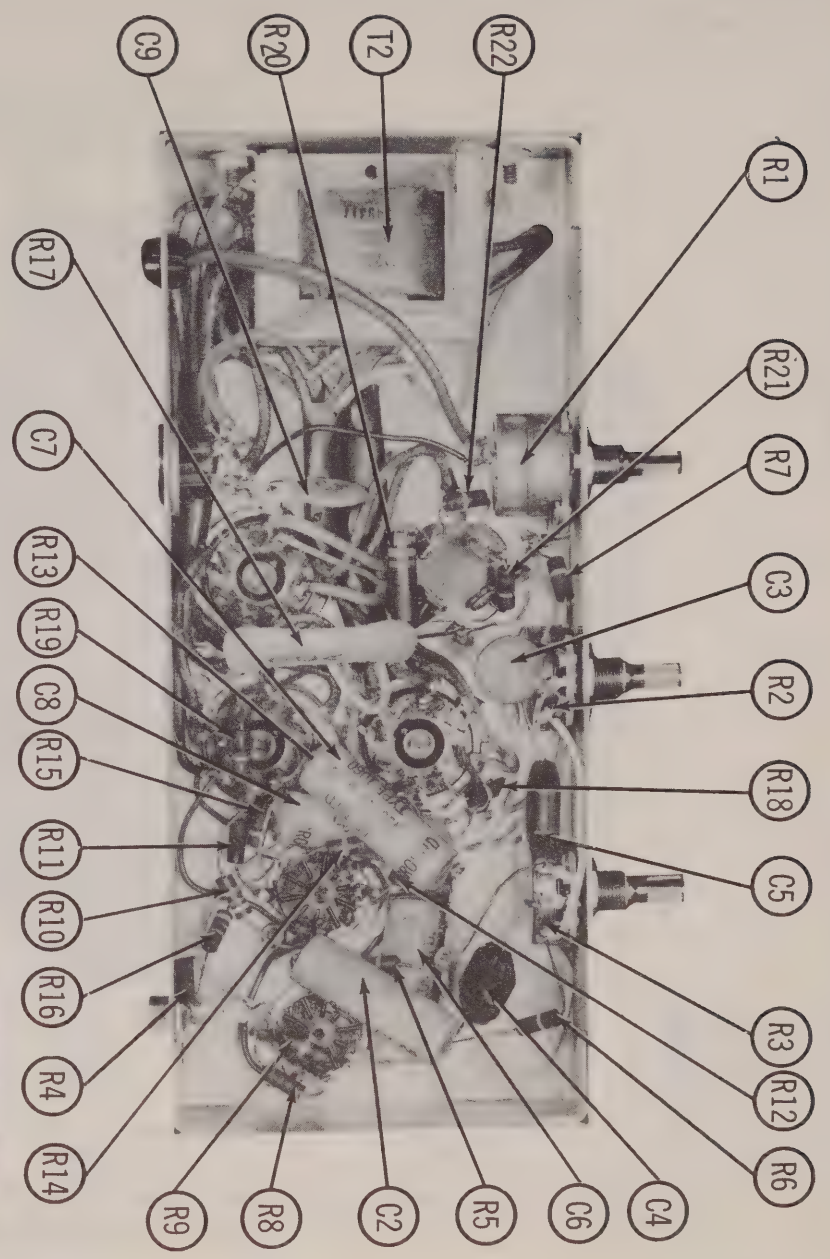
(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

ITEM No.	REPLACEMENT DATA				REMARKS
	AIRLINE PART No.	JENSEN PART No.	PERMO PART No.	WALCO PART No.	
M2	61-38 (78-Jewel) 61H3 (78-Metal)	*A-81 † A-80	*C-327 † C-308 (or) ♦ C-327D	* W-2S † W-2A	* Metal † Jewel ♦ Diamond
	6137 (33 1/3, 45-Jewel) 61H23 (33 1/3, 45-Metal)	* A-81LP † A-80LP	*A-305 † A-357 (or) ♦ A-305D	* W-2MGS †W-2MGA	

MISCELLANEOUS

ITEM No.	PART NAME	AIRLINE PART No.	NOTES
M3	Dial Light Knob	 2416	#47 3 used

CHASSIS—BOTTOM VIEW



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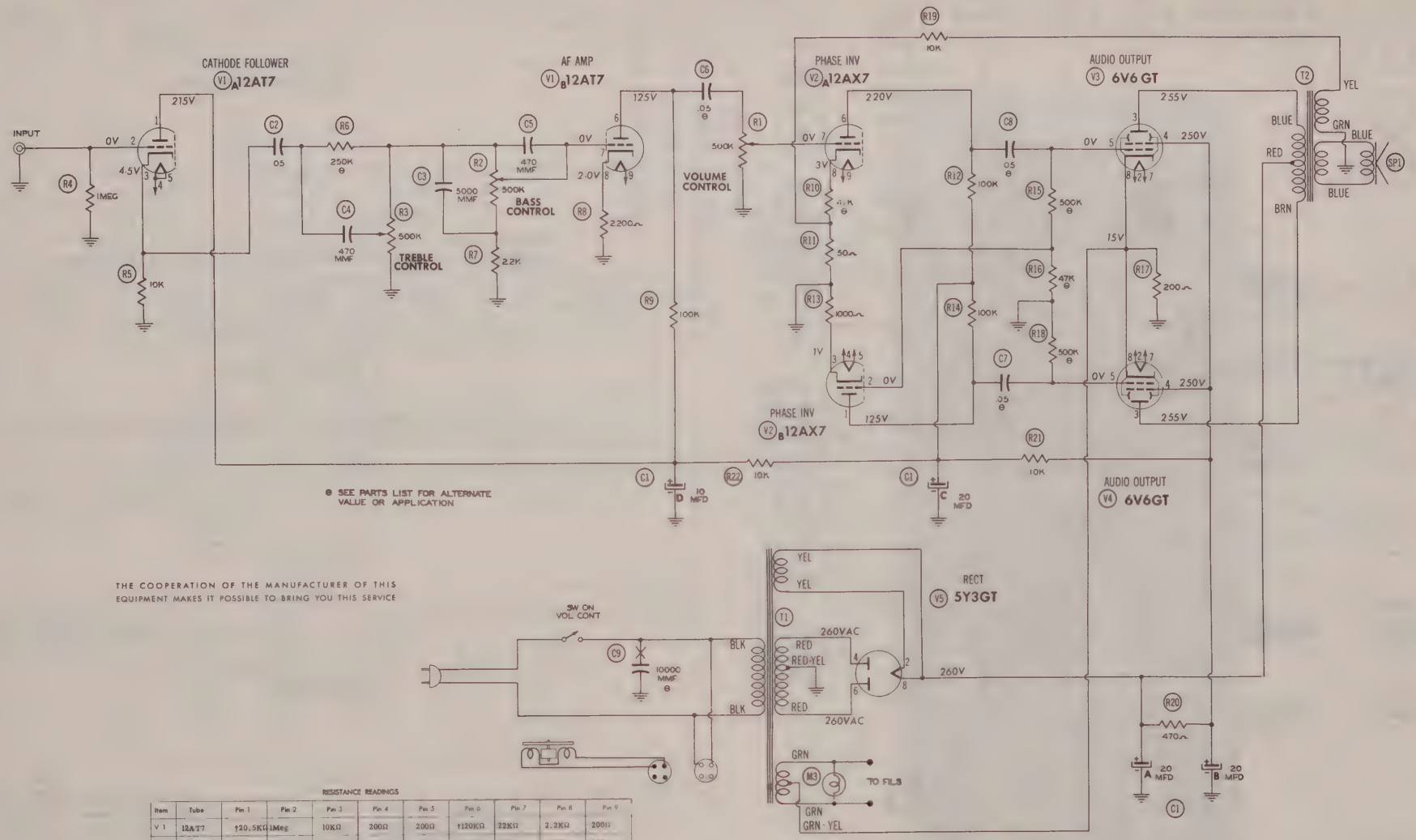

● SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AT7	†20.5KΩ	1Meg	10KΩ	200Ω	200Ω	†120KΩ	22KΩ	2.2KΩ	200Ω
V 2	12AX7	†110KΩ	47KΩ	1KΩ	200Ω	200Ω	†110KΩ	20Ω	47KΩ	200Ω
V 3	6V6GT	140Ω	200Ω	†285Ω	†470Ω	550KΩ	50Ω	200Ω	200Ω	
V 4	6V6GT	INF	200Ω	†285Ω	†470Ω	500KΩ	†10.5KΩ	200Ω	200Ω	
V 5	5Y3GT	INF	150KΩ	INF	100Ω	INF	105Ω	INF	150KΩ	

† MEASURED FROM PIN 8 OF V5

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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ALLIANCE
MODEL BB2 (VHF Booster)

ALLIANCE
MODEL BB2 (VHF Booster)

TRADE NAME	Alliance Model BB2
MANUFACTURER	The Alliance Mfg. Co., Alliance, Ohio
TYPE SET	AC Operated VHF Television Booster
TUBES (Three)	Types (2) 6J6 RF Amp. (High Band), 6BK7A RF Amp. (Low Band)
POWER SUPPLY	110-120 Volts AC- 50/60 Cycles RATING .26 Amp. @ 117 Volts AC
TUNING RANGE	Channels 2 thru 13

THIS BOOSTER HAS BEEN PROPERLY ALIGNED AT THE FACTORY AND IS VERY STABLE. ALIGNMENT SHOULD NOT BE REQUIRED IN THE FIELD.

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

"The listing of any available replacement part herein does not constitute in any case a recommendation, warranty or guaranty by Howard W. Sams & Co., Inc., as to the quality and suitability of such replacement part. The numbers of these parts have been compiled from information furnished to Howard W. Sams & Co., Inc., by the manufacturers of the particular type of replacement part listed." "Reproduction or use, without express permission, of editorial or pictorial content, in any manner, is prohibited. No patent liability is assumed with respect to the use of the information contained herein. Copyright 1954 by Howard W. Sams & Co., Inc., Indianapolis 5, Indiana, U. S. of America. Copyright under International Copyright Union. All rights reserved under Inter-American Copyright Union (1910) by Howard W. Sams & Co., Inc." Printed in U. S. of America

PARTS LIST AND DESCRIPTIONS

ALLIANCE MODEL BB2

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: ALLIANCE PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	High channel RF Amp.	6J6	6J6	7BK	
V2	High channel RF Amp.	6J6	6J6	7BK	
V3	Low channel RF Amp.	6BK7A	6BK7A	9AJ	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	40	150		PRS150/40-20		BBRD4215		2N514	TVA-2438	Red Yellow
B	20	150								
C2	5			SI5NP0	TCZ-4.7	TZ07	NP0K-050	ZT-555	5TCUB-V5	
C3	10			SI10NP0	TCZ-10	TZ09	NP0K-100	ZT-541	5TCC-Q1	
C4	1.2									
C5	1.2									
C6	100			BPD-001	D6-101	G042	GP1K-101	UC-531	5GA-T1	
C7	330			SI330	D6-331	TP43	GP2K-331	UC-5333	5GA-T33	
C8	1000			BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C9	15			SI15NP0	TCZ-15	TZ11	NP0K-150		5TCC-Q15	
C10	.05	400		489ZX-05	DF-503	PJ4S5		PT415	4TM-S5	

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ALLIANCE PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R1	3300Ω	½		BTS-3300	
R2	47Ω	½		BTS-47	
R3	3300Ω	½		BTS-3300	
R4	3300Ω	½		BTS-3300	
R5	47Ω	½		BTS-47	
R6	3300Ω	½		BTS-3300	
R7	3300Ω	½		BTS-3300	

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ALLIANCE PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R8	3300Ω	½		BTS-3300	
R9	1 Meg	½		BTS-1 Meg	
R10	1800Ω	½		BTS-1800	
R11	120Ω	2			
R12	15Ω	½		BTS-15	

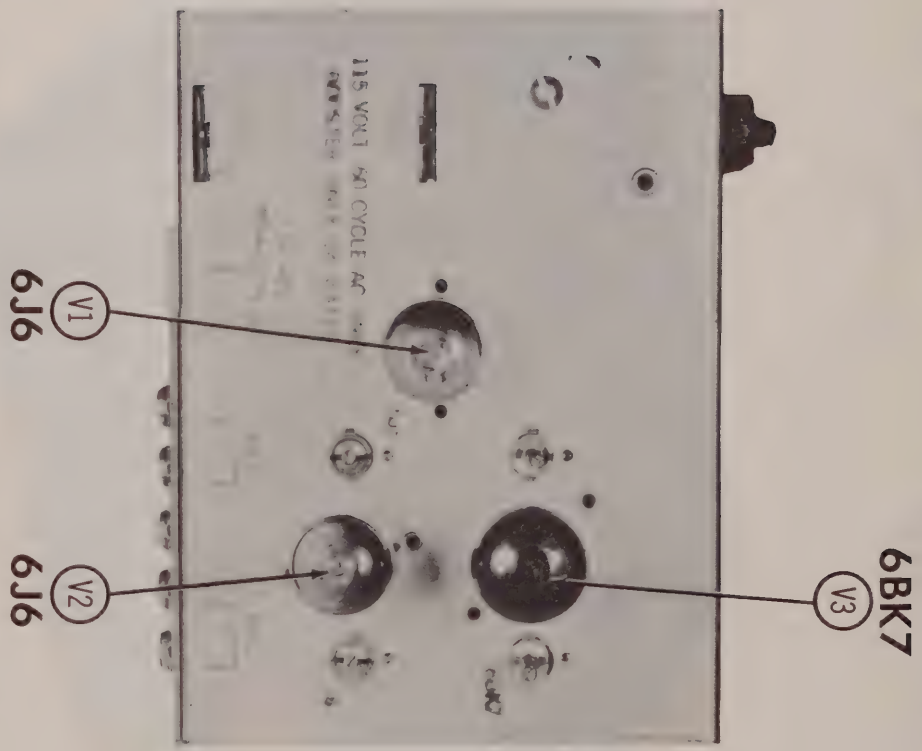
TRANSFORMER (FILAMENT)

ITEM No.	RATING: PRI.	RATING: SEC. 1	RATING: SEC. 2	RATING: SEC. 3	REPLACEMENT DATA: ALLIANCE PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @.1A	6.3VAC @1.34A								

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA: ALLIANCE PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	Booster Ant. Coil	0Ω	0ΩCT					Channels 7-13
L2	Booster Interstage Coil	0Ω	0Ω					Channel 7-13
L3	Booster Output Coil	0Ω	0Ω					Channels 7-13
L4	Booster Ant. Coil	0Ω	0Ω					Channels 2-6
L5	RF Choke	0Ω						Wound on 47Ω resistor in series
L6	Booster Output Coil	0Ω	0Ω					Channels 2-6

CHASSIS—TOP VIEW



CHASSIS—BOTTOM VIEW

PARTS LIST AND DESCRIPTIONS (Continued)

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	ALLIANCE PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	SARKES TARZIAN PART No.	SELETRON PART No.	
M1	055A	BB2	1002A	RS65	6S65	65	8J1	

MISCELLANEOUS

ITEM No.	PART NAME	ALLIANCE PART No.	NOTES
M2	Switch		Thermal type power switch

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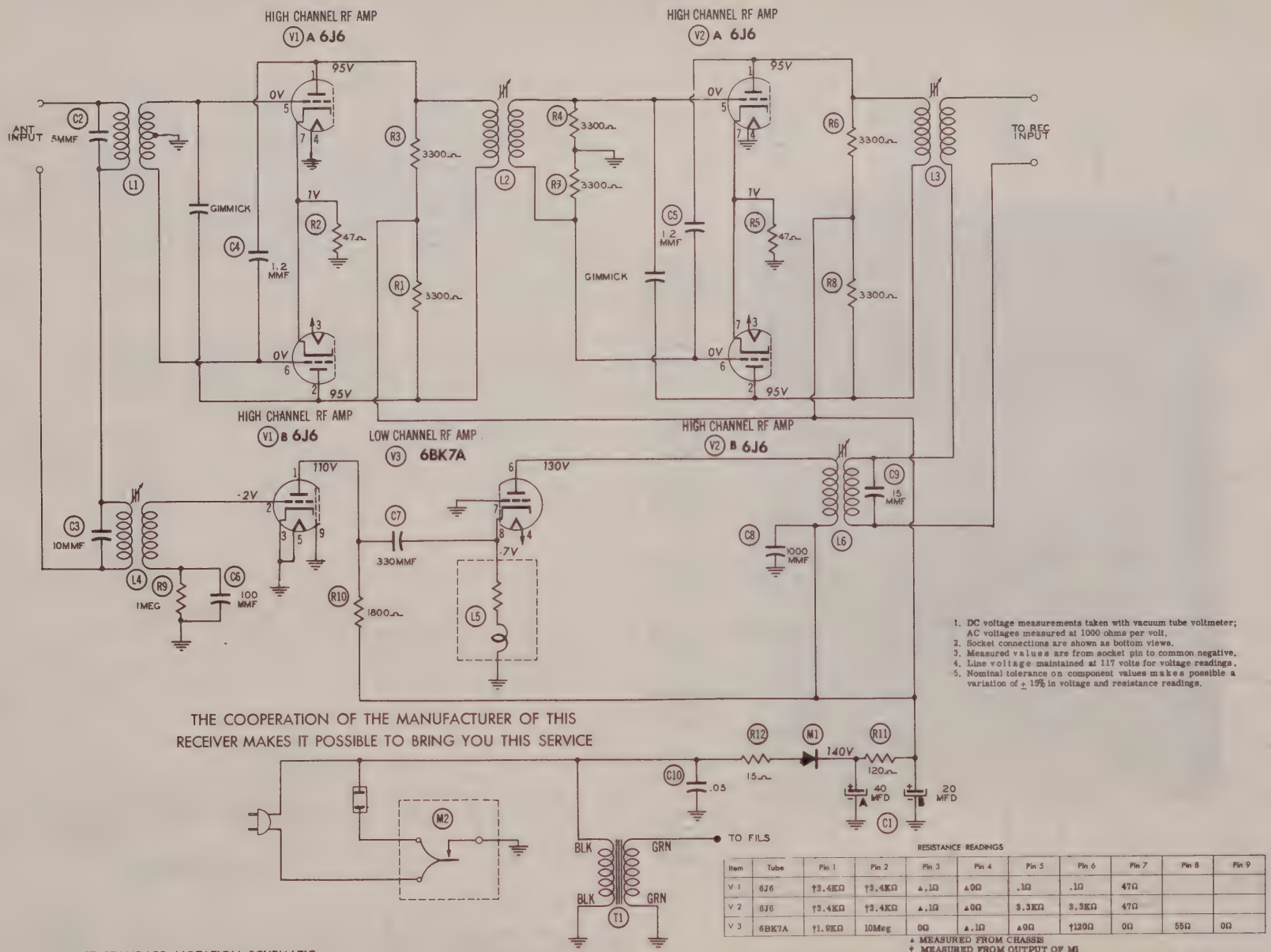
ALLIANCE
MODEL BB2



1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6J6	†3.4KΩ	†3.4KΩ	▲.1Ω	▲0Ω	.1Ω	.1Ω	47Ω		
V 2	6J6	†3.4KΩ	†3.4KΩ	▲.1Ω	▲0Ω	3.3KΩ	3.3KΩ	47Ω		
V 3	6BK7A	†1.9KΩ	10Meg	0Ω	▲.1Ω	▲0Ω	†120Ω	0Ω	55Ω	0Ω

▲ MEASURED FROM CHASSIS
† MEASURED FROM OUTPUT OF M1

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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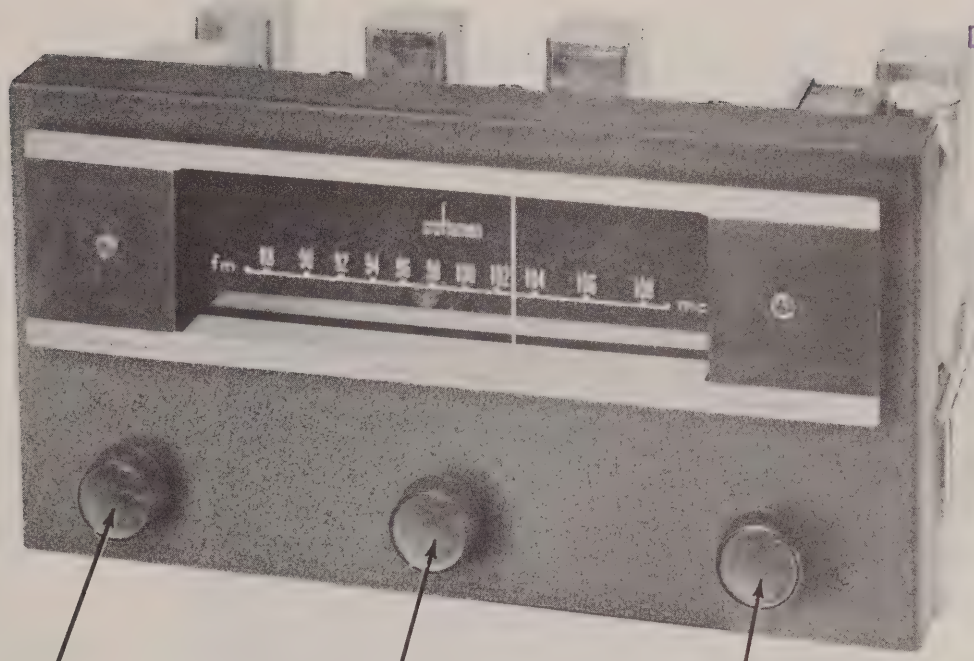
CRAFTSMEN
MODEL C900



CRAFTSMEN
MODEL C900

TRADE NAME	Craftsmen Model C900
MANUFACTURER	The Radio Craftsmen, Inc., 4401 N. Ravenswood Ave., Chicago 40, Ill.
TYPE SET	AC Operated FM Superheterodyne Tuner For Custom Installation
TUBES (Ten)	Types 6BK7A RF Amp., 6BK7A Mixer-AFC Amp., 6BK7A FM Osc.-AFC Osc., (3) 6CB6 IF Amp., 6AU6 1st. Limiter, 6CB6 2nd. Limiter, 12AU7 AF Amp.-Cathode Follower, 5Y3GT Rectifier
POWER SUPPLY	110-120 Volts AC- 50/60 Cycles RATING .56 Amp. @ 117 Volts AC
TUNING RANGE	FREQ. MOD. 88-108MC

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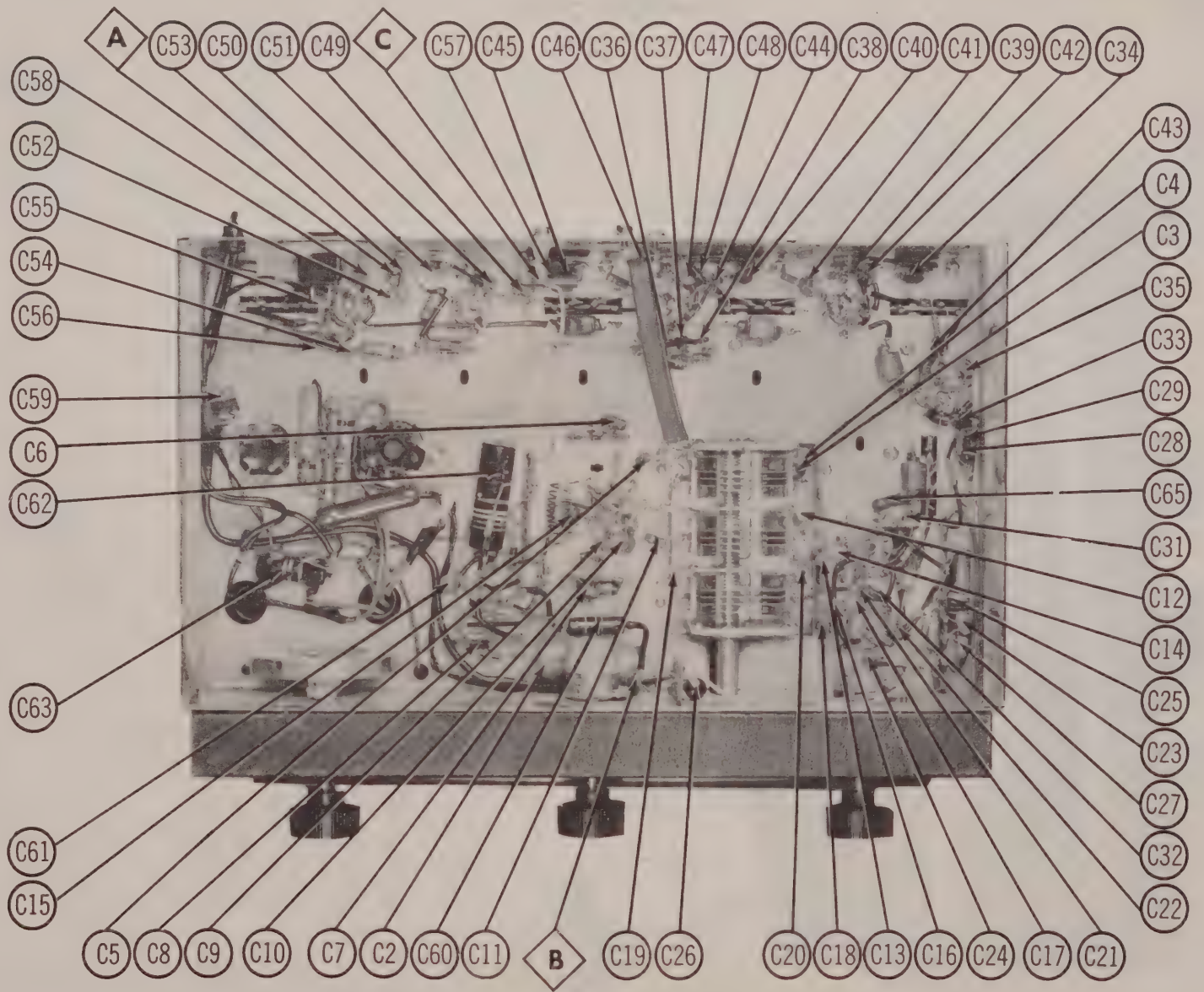
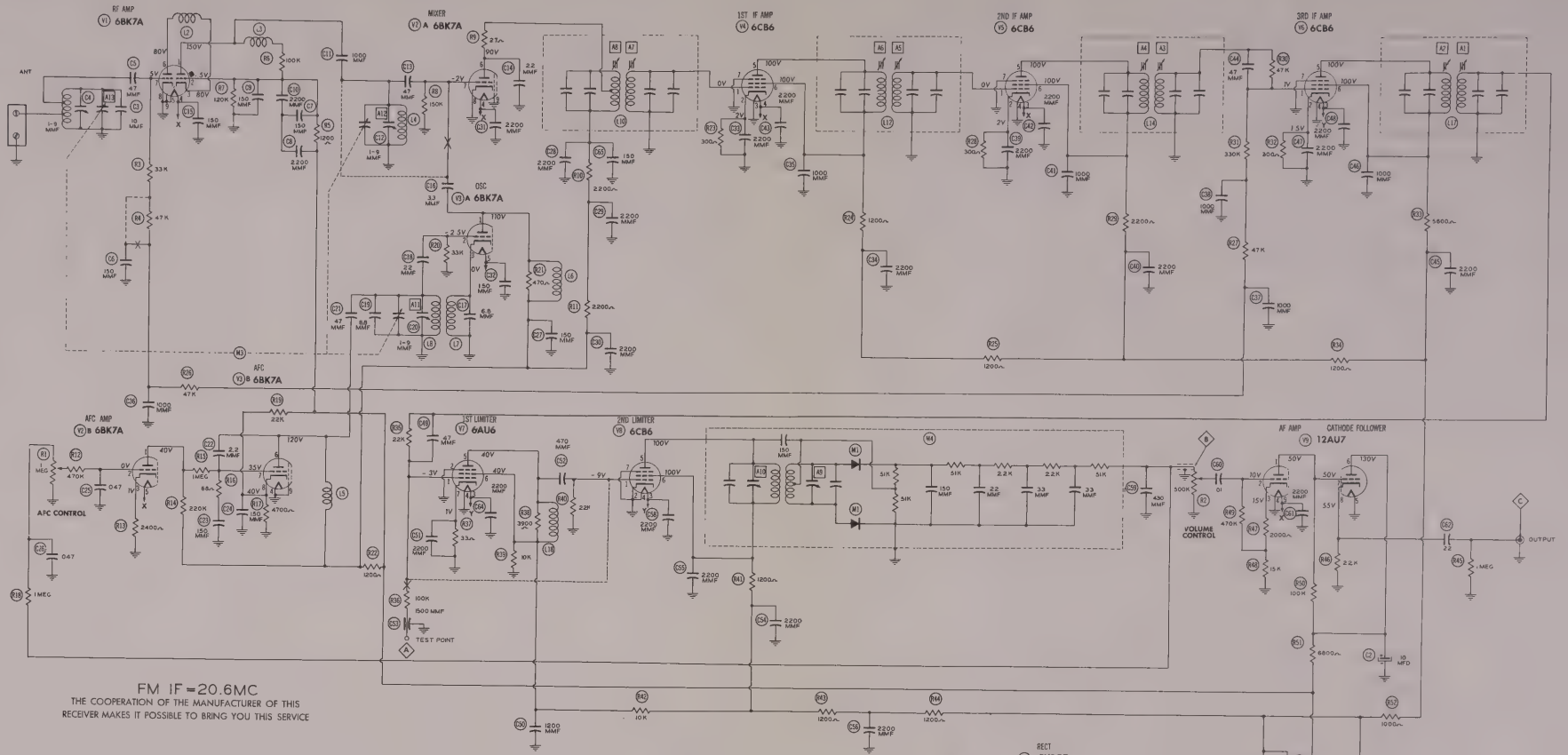


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



FM IF = 20.6MC

THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BK7A	† 2.6KΩ	120KΩ	INF	.1Ω	0Ω	INF	550KΩ	0Ω	0Ω
V 2	6BK7A	† 220KΩ	470KΩ	2.4KΩ	.1Ω	0Ω	† 7KΩ	150KΩ	0Ω	0Ω
V 3	6BK7A	2.6KΩ	33KΩ	.8Ω	0Ω	.1Ω	† 2.6KΩ	† 1.2Meg	4.7KΩ	0Ω
V 4	6CB6	.2Ω	300Ω	0Ω	.1Ω	† 6KΩ	† 6KΩ	0Ω		
V 5	6CB6	.2Ω	300Ω	.1Ω	0Ω	† 5.6KΩ	† 5.8KΩ	0Ω		
V 6	6CB6	47KΩ	300Ω	.1Ω	0Ω	† 8KΩ	† 8KΩ	0Ω		
V 7	6AU6	22KΩ	0Ω	.1Ω	0Ω	† 13.8KΩ	† 13.8KΩ	33Ω		
V 8	6CB6	22KΩ	0Ω	.1Ω	0Ω	† 5KΩ	† 5KΩ	0Ω		
V 9	12AU7	† 110KΩ	485KΩ	17KΩ	0Ω	0Ω	† 8.2KΩ	† 110KΩ	22KΩ	.1Ω
V 10	5Y3GT	INF.	12KΩ	† 0Ω	89Ω	INF.	82Ω	INF.	12KΩ	

* MEASURED FROM PIN 2 OF V1.
† MEASURED FROM PIN 2 OF V10.

DOTTED IN PARTS ARE NOT USED IN ALL MODELS. WHEN DOTTED IN PARTS ARE USED POINTS MARKED X ARE BROKEN

● SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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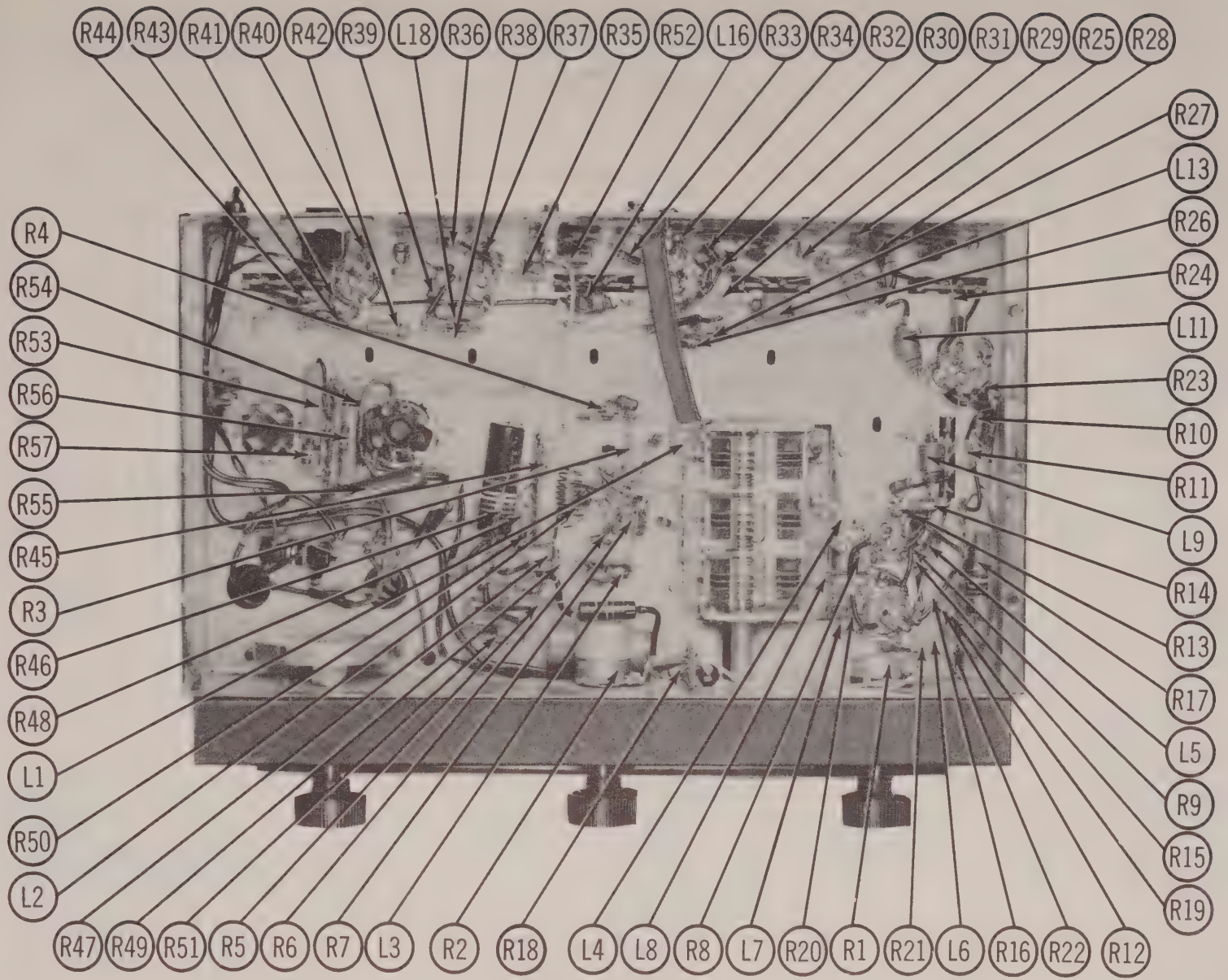

CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

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DEN —

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

A wire loop couples the primary and secondary of the IF transformers. This loop is permanently adjusted at the factory and should not be readjusted in the field.
To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial.
Use frequency modulated signal with 60~ modulation and 450KC sweep. Use 120~ sawtooth voltage in scope for horizontal deflection.
Connect a marker generator thru a 100MMF capacitor to antenna terminal marked "300Ω".
Turn volume fully clockwise and set the AFC to "off" position.
Use an insulated screwdriver for adjusting trimmers.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
1.	Direct	Across antenna terminals marked "300Ω".	98MC (450KC Swp)	98MC	Vert. Amp. to point (A). Low side to chassis.	A1, A2, A3, A4, A5, A6, A7, A8	Adjust generator output for MINIMUM noise on response curve. Adjust A1 thru A8 until a symmetrical flat-topped response curve of maximum amplitude, similar to Fig. 1 is obtained. Adjustments should be made in order given. Before proceeding to step 2, turn off the sweep generator and increase the marker generator output until limiting occurs.
2.	100MMF	Not used	Set marker generator to 98MC (Unmod)	"	Use VTVM DC probe to point (B). Common to chassis.	A9	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.
3.	Direct	Across antenna terminals marked "300Ω".	98MC (450KC Swp)	"	Vert. Amp. to point (C). Low side to chassis.	A10	Turn off marker generator. Adjust for response curve similar to Fig. 2.
4.	"	"	90MC (450KC Swp)	90MC	"		Compress or expand L8 until pattern (Fig. 2) appears on scope. Compress or expand L4 and L1 for maximum amplitude of response curve.
5.	"	"	106MC (450KC Swp)	106MC	"	A11	Adjust A11 until pattern (Fig. 2) appears on scope.
6.	"	"	"	"	"	A12, A13	Adjust for maximum amplitude of response curve. Repeat steps 6 and 7 until proper tracking is obtained.

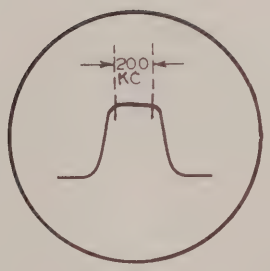


FIG. 1

FIG. 2

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

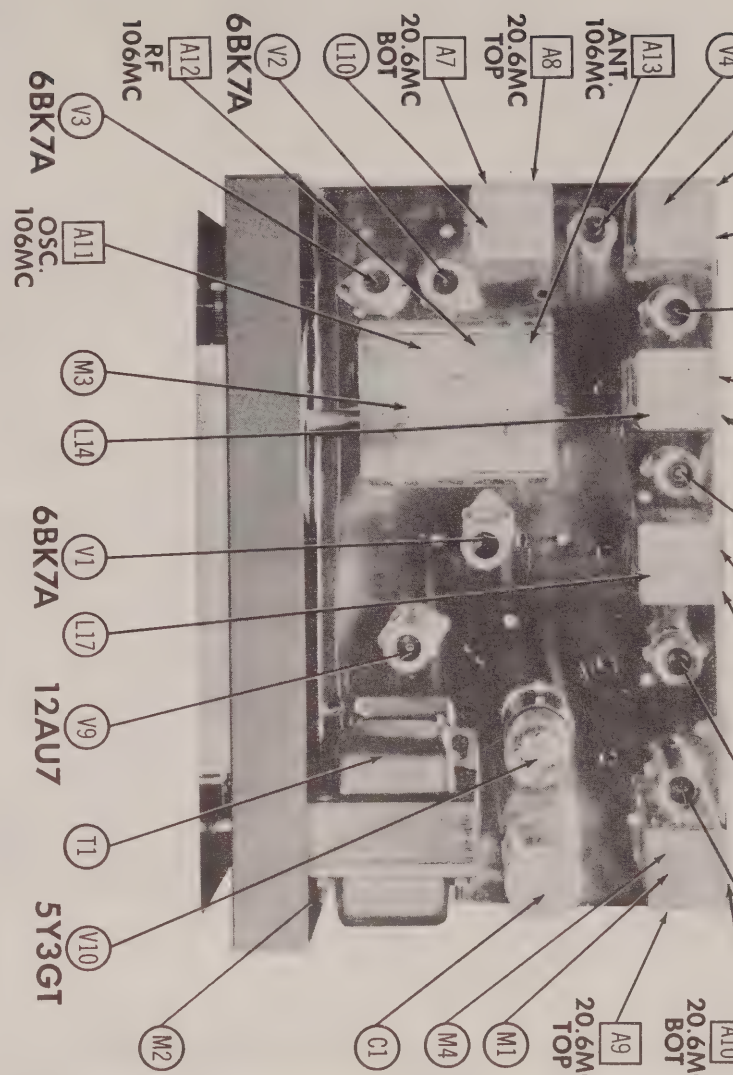
ITEM No.	USE	REPLACEMENT DATA: CRAFTSMEN PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amplifier	6BK7A	6BK7A	9AJ	
V2	Mixer-AFC Amp.	6BK7A	6BK7A	9AJ	
V3	Osc. -AFC	6BK7A	6BK7A	9AJ	
V4	1st. IF Amp.	6CB6	6CB6	7CM	
V5	2nd. IF Amp.	6CB6	6CB6	7CM	
V6	3rd. IF Amp.	6CB6	6CB6	7CM	
V7	1st. Limiter	6AU6	6AU6	7BK	
V8	2nd. Limiter	6CB6	6CB6	7CM	
V9	AF Amplifier-Cathode Follower	12AU7	12AU7	9A	
V10	Rectifier	5Y3GT	5Y3GT	5T	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: CRAFTSMEN PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	▲40	250		AFH3-44		C035		FP377	TVL-3787	
B	■40	250		PRS350/40		BR4025		TC58	TVA-1712	
C	▲40	250								
D	40	250								
C2	10	350		PRS350/10		BR1235		TC62	TVA-1604	
C3	10			SI10	D6-100	TP09	GP1K-100	UC-541	5GA-Q1	
C4	1-9									
C5	47			SI47	D6-470	TP29	GP1K- 470	UC-5447	5GA-Q47	
C6	150			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T15	
C7	150			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T15	
C8	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C9	150			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T15	
C10	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C11	1000			BPD-001	DD-102	K069	801-001	DC-521	5GA-D1	
C12	1-9									
C13	47			SI47	D6-470	TP29	GP1K-470	UC-5447	5GA-Q47	
C14	22			SI22N750	TCN-22	TN06	N750A-220		5TCU-Q22	
C15	50			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T15	
C16	3.3			SI3.3NP0	TCZ-3.3	TZ06	NP0A-3R3	ZT-5533	5TCCB-V33	
C17	6.8									
C18	22			SI22NP0	TCZ-22	TZ05	N750A-220		5TCC-Q22	
C19	6.8									
C20	1-9									
C21	47			SI47	D6-470	TP29	GP1K-470	UC-5447	5GA-Q47	
C22	2.2			SI2.2NP0	TCZ-2.2	TZ05	NP0A-2R2		5TCCB-V22	
C23	150			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T 15	
C24	150			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T15	
C25	.047	200								
C26	.047	200								
C27	150			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T15	
C28	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C29	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C30	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C31	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C32	150			SI150	D6-151	TP36	GP2K-151	UC-5315	5GA-T15	
C33	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C34	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C35	1000			BPD-001	DD-102	K069	801-001	DC-521	5GA-D1	
C36	1000			BPD-001	DD-102	K069	801-001	DC-521	5GA-D1	
C37	1000			BPD-001	DD-102	K069	801-001	DC-521	5GA-D1	
C38	1000			BPD-001	DD-102	K069	801-001	DC-521	5GA-D1	
C39	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C40	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C41	1000			BPD-001	DD-102	K069	801-001	DC-521	5GA-D1	
C42	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C43	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C44	47			SI47	D6-47	TP29	GP1K-470	UC-5447	5GA-Q47	
C45	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C46	1000			BPD-001	DD-102	K069	801-001	DC-521	5GA-D1	
C47	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	

CHASSIS—TOP VIEW



PROPERTY OF
L. F. BLANKENSHIP

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	REPLACEMENT DATA CRAFTSMEN PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C48	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C49	47			SI47N750	TCN-47	TN14	N750A-470	NT-5447	5TCU-Q47	
C50	1200			BPD-0012	D6-122	G070	GP2L-122	UC-5212	5GA-D12	
C51	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C52	470			SI470	D6-471	TP46	GP2K-471	UC-5347	5GA-T47	
C53	1500			CF-1	FT-1500		362-152			
C54	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C55	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C56	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C57	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C58	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C59	430					5R5T43				
C60	.01	400								
C61	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C62	.22	200								
C63	.01	600								
C64	2200			BPD-0022	D6-222	K073	GP2L-222	UC-5222	5GA-D22	
C65	150			SI150	D6-151	TP36	GP1K-151	UC-5315	5GA-T15	

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA CRAFTSMEN PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1 Meg	½	23S738	Q13-137	A47-1Meg-Z	B-70	U-53	AFC
B	Shaft		Not Req.	Not Req.	RS-3	Not Req.	Not Req.	Attach to R1A
R2A	500KΩ	½	23S736	Q13-133	A47-500K-Z	B-60-S	U-48	Volume
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R2A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R2A

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA CRAFTSMEN PART No.	IRC PART No.	NOTES
R3	33KΩ	½		BTS-33K	
R4	47KΩ	½		BTS-47K	
R5	1200Ω	½		BTS-1200	
R6	100KΩ	½		BTS-100K	
R7	120KΩ	½		BTS-120K	
R8	150KΩ	½		BTS-150K	
R9	27Ω	½			Note 1
R10	2200Ω	½		BTS-2200	
R11	2200Ω	½		BTS-2200	
R12	470KΩ	½		BTS-470K	
R13	2400Ω	½		BTS-2400	
R14	220KΩ	½		BTS-220K	
R15	1 Meg	½		BTS-1 Meg	
R16	68Ω	½			
R17	4700Ω	1		BTA-4700	
R18	1 Meg	½		BTS-1 Meg	
R19	22KΩ	1		BTA-22K	
R20	33KΩ	½		BTS-33K	
R21	470Ω	½		BTS-470	
R22	1200Ω	½		BTS-1200	
R23	300Ω	½			
R24	1200Ω	½		BTS-1200	
R25	1200Ω	½		BTS-1200	
R26	47KΩ	½		BTS-47K	
R27	47KΩ	½		BTS-47K	
R28	300Ω	½			
R29	2200Ω	½		BTS-2200	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA CRAFTSMEN PART No.	IRC PART No.	NOTES
R30	47KΩ	½		BTS-47K	
R31	330KΩ	½		BTS-330K	
R32	300Ω	½			
R33	5600Ω	½		BTS-5600	
R34	1200Ω	½		BTS-1200	
R35	22KΩ	½		BTS-22K	
R36	100KΩ	½		BTS-100K	
R38	3900Ω	½		BTS-3900	
R39	10KΩ	1		BTA-10K	
R40	22KΩ	½		BTS-22K	
R41	1200Ω	½		BTS-1200	
R42	10KΩ	1		BTA-10K	
R43	1200Ω	½		BTS-1200	
R44	1200Ω	½		BTS-1200	
R45	1 Meg	½		BTS-1 Meg	
R46	22KΩ	½		BTS-22K	
R47	2000Ω	½			
R48	15KΩ	½		BTS-15K	
R49	470KΩ	½		BTS-470K	
R50	100KΩ	½		BTS-100K	
R51	6800Ω	½		BTS-6800	
R52	1000Ω	1		BTA-1000	
R53	1000Ω	2		BTB-1000	Note 2
R54	1000Ω	2		BTS-1000	Note 2
R55	400Ω	10		1 3/4A-400	
R56	3900Ω	½		BTS-3900	Note 3
R57	3900Ω	½		BTS-3900	Note 3

Note 1. Some models may use a 27Ω resistor in this application.
Note 2. Some models may use a 820Ω resistor in this application.
Note 3. Not used in all models.

CHASSIS—BOTTOM VIEW

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA CRAFTSMEN PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @ .56A	464VCT .084A	5VAC @ 2A	6.3VAC @ 3.7A						

COILS (RF-IF)

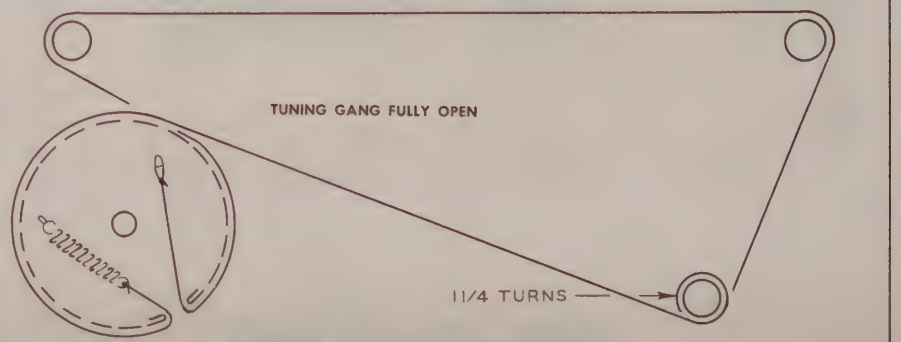
ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA CRAFTSMEN PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1	Ant. Coil	0Ω (tapped)						
L2	Neutr. Coil	0Ω						
L3	RF Choke	3Ω			19-1003		4608	3.3 Microhenries; IRC Part # CLA
L4	RF Coil	0Ω						
L5	RF Choke	3Ω			19-1003		4608	3.3 Microhenries; IRC Part # CLA
L6	RF Choke	0Ω						
L7	RF Choke	.8Ω			19-1000		4602	1 Microhenry; IRC Part # CLA
L8	Osc. Coil	0Ω						
L9	Fil. Choke	0Ω			19-1003		4608	3.7 Microhenries
L10	1st FM IF	.1ΩCT	.1Ω	5M023-1				
L11	Fil. Choke	0Ω			19-1003		4608	3.7 Microhenries
L12	2nd FM IF	.1Ω	.1Ω	5M023-2				
L13	Fil. Choke	0Ω			19-1003		4608	3.7 Microhenries
L14	3rd FM IF	.1Ω	.1Ω	5M023-3				
L15	Fil. Choke	0Ω			19-1003		4608	3.7 Microhenries; Not used in all models
L16	Fil. Choke	0Ω			19-1003		4608	3.7 Microhenries
L17	4th FM IF	.1Ω	.1Ω	5M023-4				
L18	RF Choke	2.2Ω			19-1002		4606	2.7 Microhenries; IRC Part # CLA

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA CRAFTSMEN PART No.	SYLVANIA PART No.	FEDERAL PART No.	NOTES
M1	1N64		1N132	1N64A	2 used-detector assembly

MISCELLANEOUS

ITEM No.	PART NAME	CRAFTSMEN PART No.	NOTES
M2	Dial Light		# 44 - 2 used
M3	Tuning cap		
M4	Detector assembly		Includes 2 1N64 crystal diodes



DRIVE CORD STRINGING

PROPERTY OF
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DENVER, COLORADO

DAVID BOGEN
MODEL DB10A

FUNCTION SELECTOR SWITCH

VOLUME CONTROL ON-OFF SWITCH

BASS CONTROL

TREBLE CONTROL

DAVID BOGEN
MODEL DB10A

TRADE NAME	David Bogen Model DB10A
MANUFACTURER	David Bogen Co., Inc., 29 Ninth Ave., New York, 14, N.Y.
TYPE SET	AC Operated 5 Channel 10 Watt Audio Amplifier
TUBES (Six)	Types 12AT7 Pre-Amp., 6SF5 AF Amp., 6SL7GT AF Amp.-Phase Inv., (2) 6V6GT Audio Output, 5Y3GT Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .6 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

DAVID BOGEN
MODEL DB10A

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		David Bogen PART No.	STANDARD REPLACEMENT		
V1	Pre. Amplifier	12AT7	12AT7	9A	
V2	AF Amplifier	6SF5	6SF5	6AB	
V3	AF Amplifier-Phase Inverter	6SL7GT	6SL7GT	8BD	
V4	Output	6V6GT	6V6GT	7S	
V5	Output	6V6GT	6V6GT	7S	
V6	Rectifier	5Y3GT	5Y3GT	5T	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

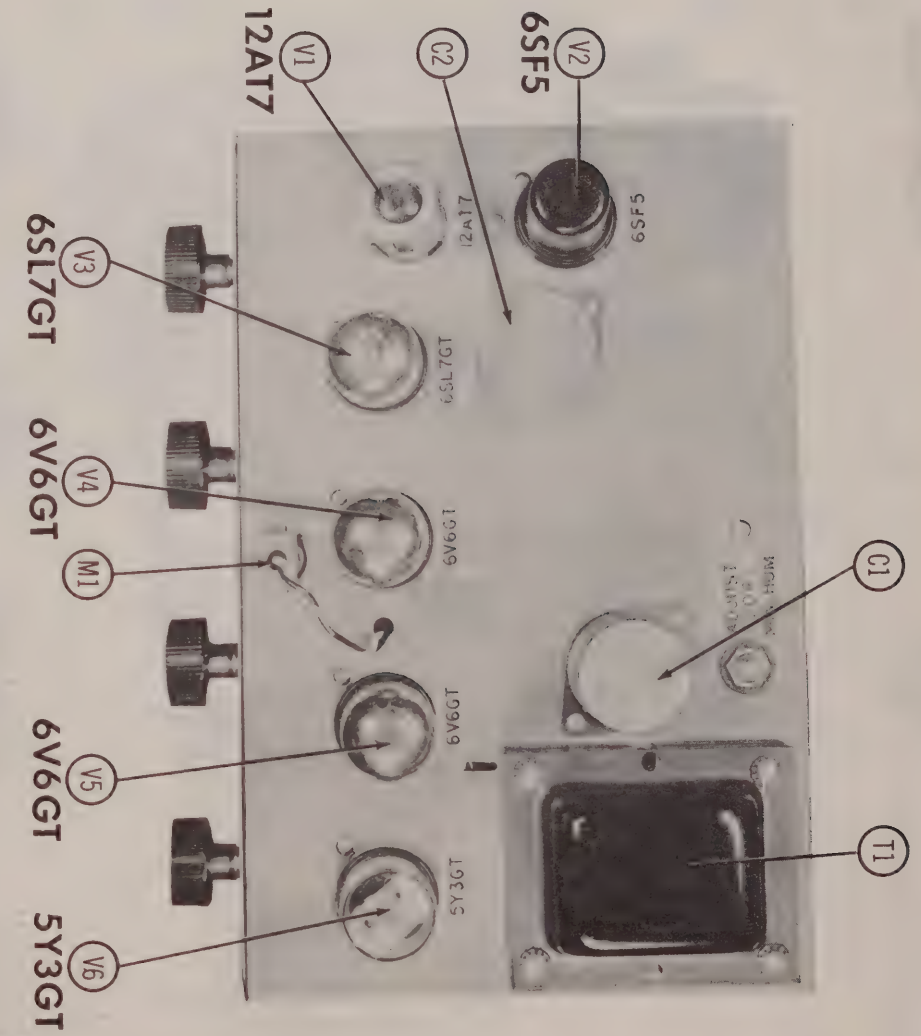
ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	David Bogen PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C1A	▲10	450		AFH4-09		D008		WP333.6	R1508	
B	▲10	450								
C2A	▲5	450								
B	■5	450		AFH4-09		D008		WP433.6	A1424	
C	▲5	450								
D	5	450								
C3	50	50		PRS50/50		BR505		TC39	TVA-1308	
C4	.006	600		P688-006	D6-602	CUB6D2	GP2-333-602	PT626	6TM-D6	
C5	.02	400		P488-02	DF-203	CUB4S2		PT412	4TM-S2	
C6	100	500		1469-0001		5W5T1		MC235	1FM-31	
C7	.0047	200		P688-0047	D6-472	CUB6D47	GP2-333-472	PT6247	6TM-D47	
C8	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C9	.001	200		P688-001	D6-102	CUB6D1	GP2-333-102	PT621	6TM-D1	
C10	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C11	100	500		1469-0001		5W5T1		MC235	1FM-31	
C12	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C13	500	500		1469-0005		5W5T5		MC245	1FM-35	
C14	.001	200		P688-001	D6-102	CUB6D1	GP2-333-102	PT621	6TM-D1	
C15	3300	500		1464-003		1W5D33		MC461	1FM-23	
C16	.01	200		P288-01	D6-103	PJ2S1	GP2-333-103	PT411	2TM-S1	
C17	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C18	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C19	250	500		1469-00025		1W5T25		MC240	1FM-325	
C20	750	500		1469-00075		1W5T75		MC251	1FM-37	
C21	4700	500		1464-005		1W5D47		MC465	1FM-25	
C22	.01	200		P288-01	D6-103	PJ2S1	GP2-333-103	PT411	2TM-S1	
C23	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C24	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C25	.01	600		689ZX-01	D6-103	PJ6S1	GP2-333-103	PT611	6TM-S1	Note 1

Note 1. Some models use an .047MFD @ 600V in this application.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	David Bogen PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	2 Meg	½	V337	Q11-139				Treble
B	2 Meg	½		M11-139				
R2A	2 Meg	½	V336A	Q13-139				Bass
B	2 Meg	½		M13-139				
R3A	500KΩ	½	V323	Q13-133	A47-500K-Z	B-60-S	U-48	Volume
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R3A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R3A
R4A	50Ω	2		W-50	A43-50		C50P	Hum balance- wire wound
B	Shaft		Not Req		RS-2		Not Req.	Attach to R4A

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA David Bogen PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R5	100KΩ	1/2		BTS-100K	
R6	47KΩ	1/2		BTS-47K	
R7	470KΩ	1/2		BTS-470K	
R8	680Ω	1/2		BTS-680	
R9	100KΩ	1/2		BTS-100	
R10	1 Meg	1/2		BTS-1 Meg	
R11	680Ω	1/2		BTS-680	
R12	100KΩ	1/2		BTS-100K	
R13	47KΩ	1/2		BTS-47K	
R14	68KΩ	1/2		BTS-68K	
R15	220KΩ	1/2		BTS-220K	
R16	47KΩ	1/2		BTS-47K	
R17	3.3Meg	1/2		BTS-3.3Meg	
R18	270KΩ	1/2		BTS-270K	
R19	220KΩ	1/2		BTS-220K	
R20	47KΩ	1/2		BTS-47K	
R21	100KΩ	1/2		BTS-100K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA David Bogen PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R22	100KΩ	1/2		BTS-100K	
R23	470KΩ	1/2		BTS-470K	
R24	2200Ω	1/2		BTS-2200	
R25	2200Ω	1/2		BTS-2200	
R26	220KΩ	1/2		BTS-220K	
R27	10KΩ	1/2		BTS-10K	
R28	220KΩ	1/2		BTS-220K	
R29	220KΩ	1/2		BTS-220K	
R30	270Ω	2			
R31	220KΩ	1/2		BTS-220K	
R32	1000Ω	1/2		BTS-1000	
R33	47KΩ	1/2		BTS-47K	
R34	47KΩ	2		BTB-47K	
R35	4.7Ω	1/2			
R36	250Ω	7		1 3/4A-250	
R37	2200Ω	2		BTB-2200	

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA David Bogen PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @.60A	686VCT .077ADC	5VAC @2A	6.3VAC @2.5A	T362-1	PM-8409 ①	P-2952①	R-11B ①	P9311 ①	TS-24R04 ①

① Tape 6.3V center tap.

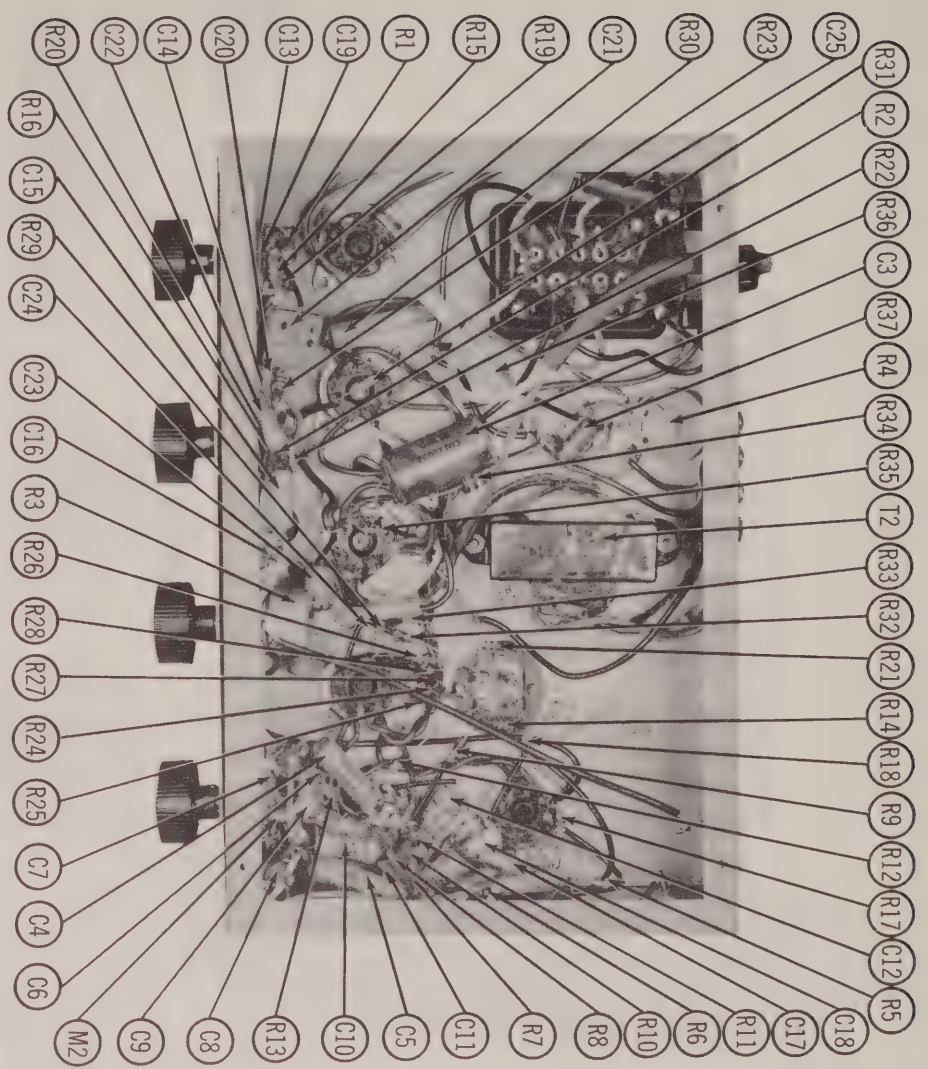
TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA David Bogen PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	NOTES
T2	10KΩ CT	16Ω tap@ 8Ω, 4Ω	T292		A-3027		Z1404	22S44	

MISCELLANEOUS

ITEM No.	PART NAME	David Bogen PART No.	NOTES
M1	Dial Light		#47
M2	Switch		Input Selector-Record Compensator

CHASSIS—BOTTOM VIEW



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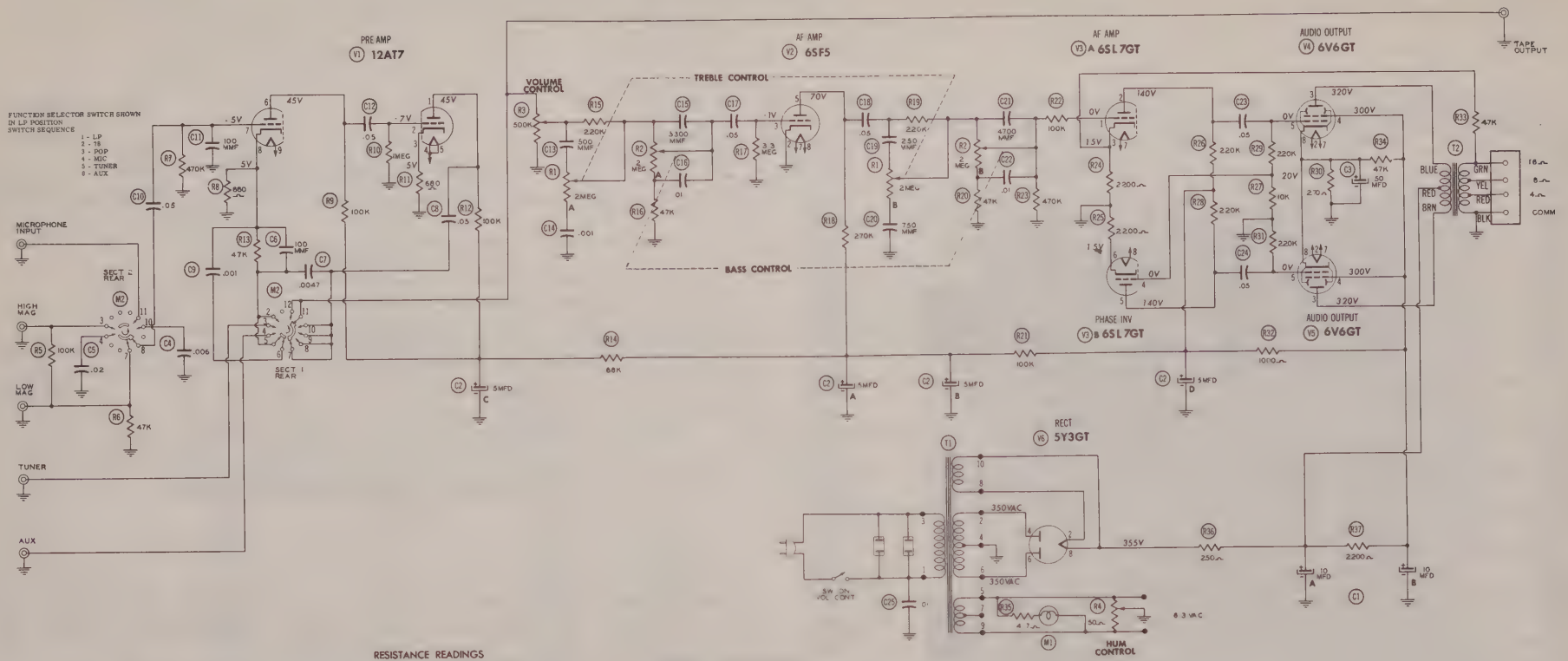
DAVID BOGEN
MODEL DB10A

DAVID BOGEN
MODEL DB10A



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AT7	†270KΩ	1Meg	680Ω	2Ω	2Ω	†270KΩ	470KΩ	680Ω	2Ω
V 2	6SF5	0Ω	0Ω	3.3Meg	270KΩ	†370KΩ	INF	2Ω	2Ω	
V 3	6SL7GT	270KΩ	†220KΩ	2.2KΩ	10KΩ	†220KΩ	2.2KΩ	2Ω	2Ω	
V 4	6V6GT	0Ω	2Ω	†450Ω	†2.4KΩ	230KΩ	220KΩ	2Ω	270Ω	
V 5	6V6GT	0Ω	2Ω	†450Ω	†2.4KΩ	220KΩ	INF	2Ω	270Ω	
V 6	5Y3GT	INF	50KΩ	INF	175Ω	INF	185Ω	INF	50KΩ	

† MEASURED FROM PIN 2 OF V6

THE COOPERATION OF THE MANUFACTURER OF THIS EQUIPMENT MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

1. DC voltage measurements taken with vacuum tube voltmeter. AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings.

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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DAVID BOGEN
MODEL JOH, JOL

DAVID BOGEN
MODEL JOH, JOL

TRADE NAME	David Bogen Models JOH, JOL
MANUFACTURER	David Bogen Co., Inc., 29 Ninth Ave., New York, 14, N.Y.
TYPE SET	AC Operated 5 Channel Audio Pre-Amplifier
TUBES (Seven)	Types (4) 6SF5 Mic-Pre-Amp., 6SF5 Mixer, 6SN7GT AF Amp.-Cathode Follower, 6X5GT Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .22 Amp. @ 117 Volts AC

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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PARTS LIST AND DESCRIPTIONS

DAVID BOGEN
MODEL JOH

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		David Bogen PART No.	STANDARD REPLACEMENT		
V1	Mic Pre. Amp.	6SF5	6SF5	6AB	
V2	Mic Pre. Amp.	6SF5	6SF5	6AB	
V3	Mic Pre. Amp.	6SF5	6SF5	6AB	
V4	Mic Pre. Amp.	6SF5	6SF5	6AB	
V5	Mixer	6SF5	6SF5	6AB	
V6	AF Amplifier-Cathode Follower	6SN7GT	6SN7GT	8BD	
V7	Rectifier	6X5GT	6X5GT	6S	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

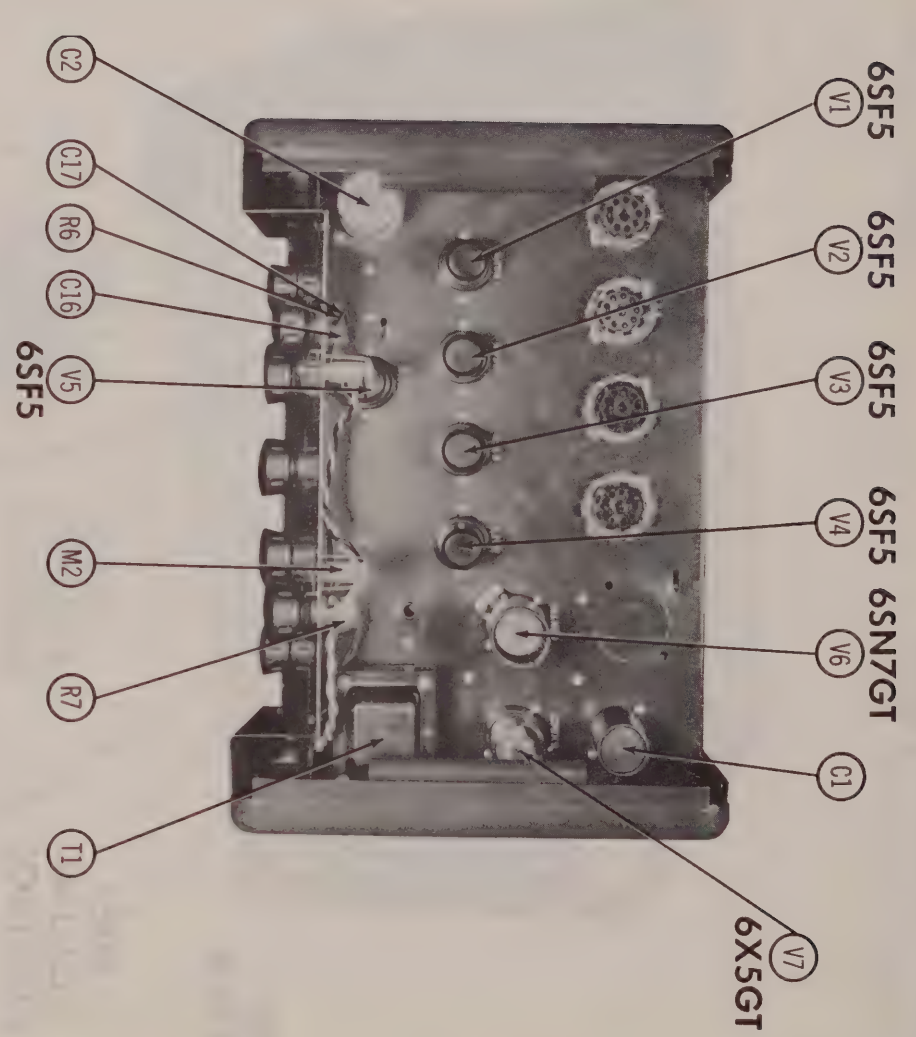
ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	David Bogen PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C1A	▰40	150		AFH3-09		C008		FP311.4	TVL-3437	
B	▲30	150								
C	10	150								
C2A	■5	450		AFH4-09		D008		WP433.6	R1424	
B	▰5	450								
C	▲5	450								
D	5	450								
C3	100	25		PRS25/100		BRH251		TC2501	TVA-1207	
C4	100	25		PRS25/100		BRH251		TC2501	TVA-1207	
C5	100	25		PRS25/100		BRH251		TC2501	TVA-1207	
C6	100	25		PRS25/100		BRH251		TC2501	TVA-1207	
C7	10	25		PRS25/10		BR102		TC22	TVA-1204	
C8	10	25		PRS25/10		BR102		TC22	TVA-1204	
C9	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C10	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C11	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C12	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C13	.5	100		P288-5		PJ2P5		PT405	2TM-P5	
C14	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C15	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C16	500	500		1469-0005		5W5T5		MC245		
C17	.002	600		P688-002	D6-202	CUB6D2	GP2-333-202	PT622	6TM-D2	
C18	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C19	.5	400		P488-5		CUB4P5				
C20	.5	400		P488-5		CUB4P5				Note 1
C21	.1	600		689ZX-1	DF-104	PJ6P1		PT601	6TM-P1	

Note 1. Some models may use 1MFD Ⓐ 400V in this application.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	David Bogen PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	500KΩ	½	V202C	Q13-133	A47-500K-Z	B-60	U-48	Microphono No. 1
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A
R2A	500KΩ	½	V202C	Q13-133	A47-500K-Z	B-60	U-48	Microphono No. 2
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R2A
R3A	500KΩ	½	V202C	Q13-133	A47-500K-Z	B-60	U-48	Microphono No. 3
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R3A
R4A	500KΩ	½	V202C	Q13-133	A47-500K-Z	B-60	U-48	Microphono No. 4
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R4A
R5A	500KΩ	½	V202C	Q13-133	A47-500K-Z	B-60	U-48	Phonograph volume
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R5A
R6	4 Meg	½	V-129E				U-65	Tone tapped Ⓐ 45K
R7A	500K Ω		V149B	Q13-133	A47-500K-Z	B-60-S	U-48	Volume
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R7A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R7A

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	David Bogen PART No.	IRC PART No.	
R8	470KΩ	½		BTS-470K	
R9	4700Ω	½		BTS-4700	
R10	220KΩ	½		BTS-220K	
R11	100KΩ	½		BTS-100K	
R12	220KΩ	½		BTS-220K	
R13	220KΩ	½		BTS-220K	
R14	470KΩ	½		BTS-470K	
R15	4700Ω	½		BTS-4700	
R16	220KΩ	½		BTS-220K	
R17	100KΩ	½		BTS-100K	
R18	220KΩ	½		BTS-220K	
R19	470KΩ	½		BTS-470K	
R20	4700Ω	½		BTS-4700	
R21	220KΩ	½		BTS-220K	
R22	100KΩ	½		BTS-100K	
R23	220KΩ	½		BTS-220K	
R24	470KΩ	½		BTS-470K	
R25	4700Ω	½		BTS-4700	
R26	220KΩ	½		BTS-220K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	David Bogen PART No.	IRC PART No.	
R27	100KΩ	½		BTS-100K	
R28	470KΩ	½		BTS-470K	
R29	2200Ω	½		BTS-2200	
R30	100KΩ	½		BTS-100K	
R31	22KΩ	½		BTS-22K	
R32	6800Ω	½		BTS-6800	
R33	220KΩ	½		BTS-220K	
R34	220KΩ	½		BTS-220K	
R35	1000Ω	½		BTS-1000	
R36	15KΩ	½		BTS-15K	
R37	22KΩ	½		BTS-22K	
R38	2200Ω	½		BTS-2200	
R39	47KΩ	½		BTS-47K	
R40	3300Ω	½		BTS-3300	
R41	2200Ω	½		BTS-2200	
R42	100Ω	1			
R43	100Ω	1			
R44	4.7Ω	1			

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	David Bogen PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @.22A	290VCT .008A	6.3VAC @1.7A		T-375A					22R38

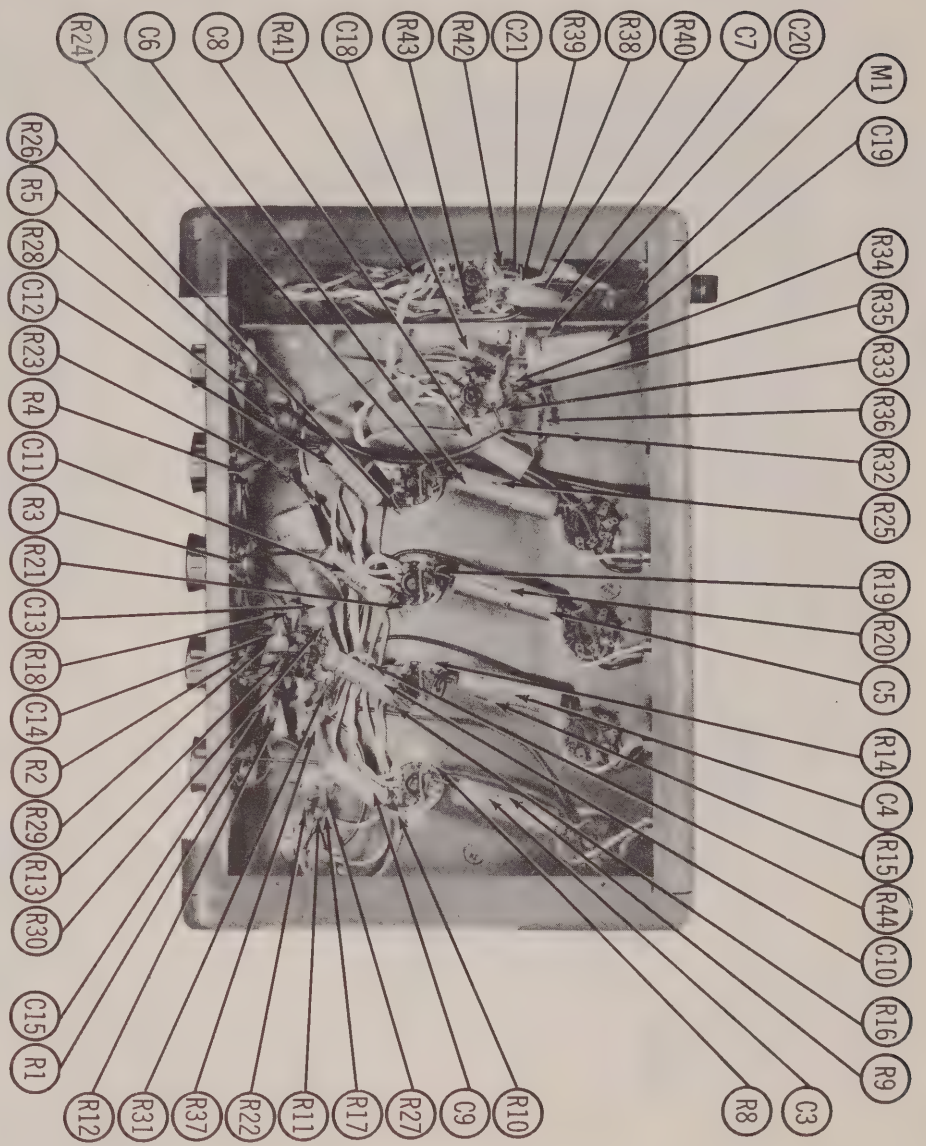
FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			David Bogen PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG	1A 250V			312001 (3AG-1A)	342001	AGC 1	HKP

MISCELLANEOUS

ITEM No.	PART NAME	David Bogen PART No.	NOTES
M2	Dial Light		2 used #47

CHASSIS—BOTTOM VIEW



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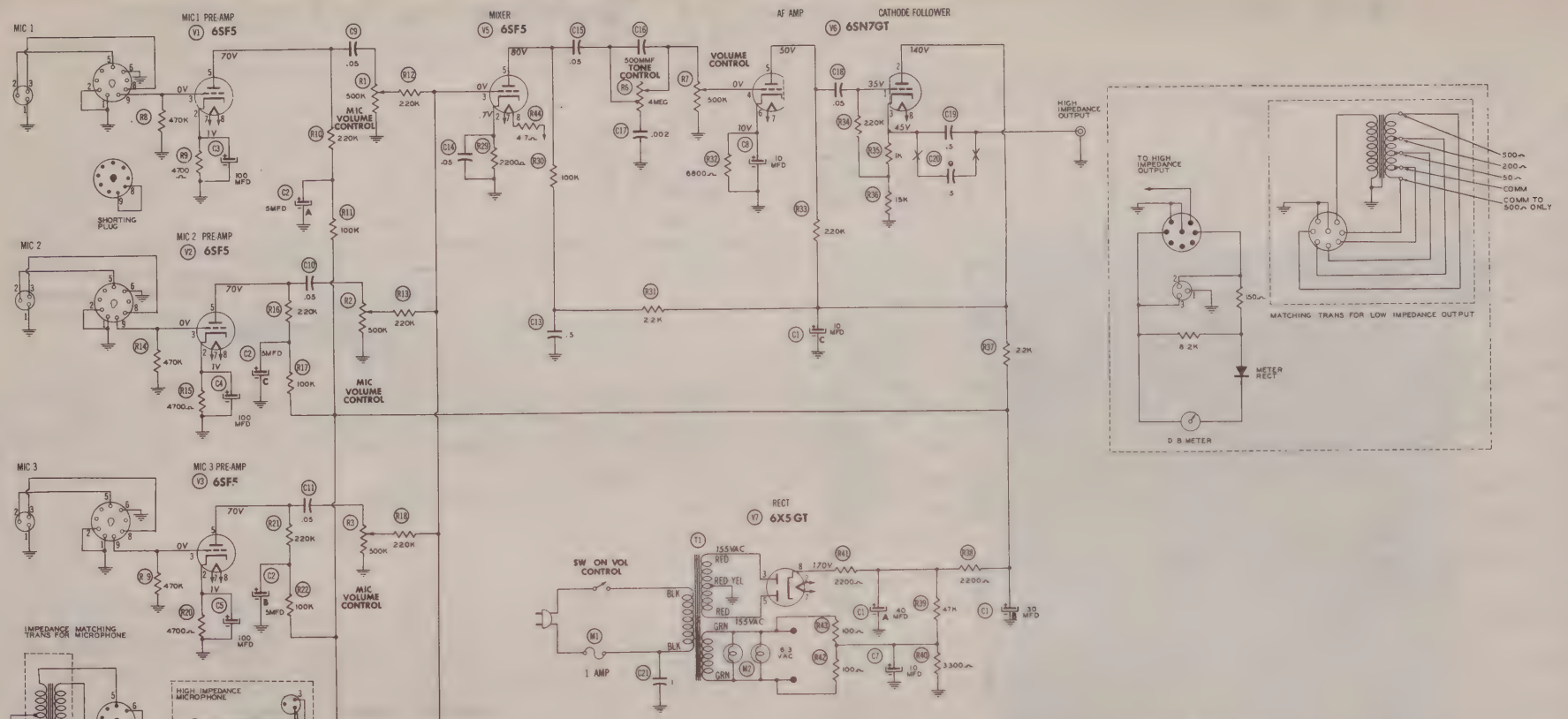
DAVID BOGEN
MODEL JOH

David Bogen
MODEL JOH



THE COOPERATION OF THE MANUFACTURER OF THIS EQUIPMENT MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

1. DC voltage measurements taken with vacuum tube voltmeter.
2. AC voltages measured at 1000 ohms per volt.
3. Socket connections are shown as bottom views.
4. Measured values are from socket pin to common negative.
5. Line voltage maintained at 117 volts for voltage readings.
6. Nominal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings.
7. All controls at minimum, proper output load connected.

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V 1	6SF5	0Ω	4.7KΩ	470KΩ	0Ω	†325KΩ	†105KΩ	3.3KΩ	3.3KΩ
V 2	6SF5	0Ω	4.7KΩ	470KΩ	0Ω	†325KΩ	†105KΩ	3.3KΩ	3.3KΩ
V 3	6SF5	0Ω	4.7KΩ	470KΩ	0Ω	†325KΩ	†105KΩ	3.3KΩ	3.3KΩ
V 4	6SF5	0Ω	4.7KΩ	470KΩ	0Ω	†325KΩ	†105KΩ	3.3KΩ	3.3KΩ
V 5	6SF5	0Ω	2.2KΩ	60KΩ	0Ω	†150KΩ	†50KΩ	3.3KΩ	3.3KΩ
V 6	6SN7GT	235KΩ	†4.4KΩ	16KΩ	500KΩ	†245KΩ	6.8KΩ	3.3KΩ	3.3KΩ
V 7	6X5GT	INF	3.3KΩ	90Ω	3.3KΩ	90Ω	INF	3.3KΩ	50KΩ

† MEASURED FROM PIN 8 OF V7

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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DENVER, COLORADO

AMPEX
MODELS 400A, 401A

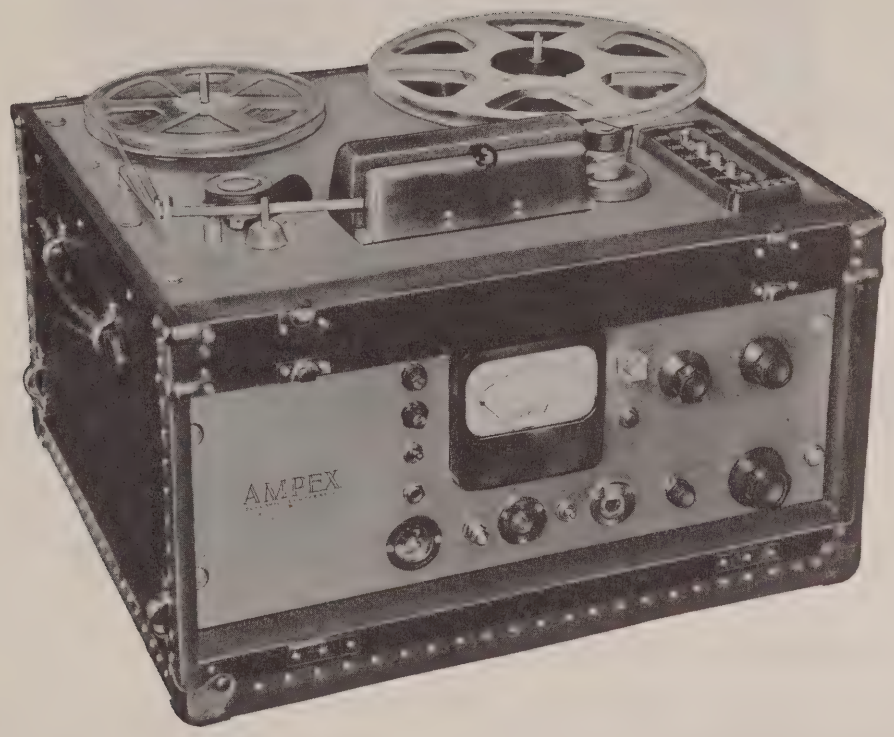

Figure 1

GENERAL INFORMATION

The Ampex Models 400A and 401A are identical in every respect except for the Head Assembly. Model 400A incorporates heads to erase and record on only one-half of the standard 1/4 inch tape. Model 401A incorporates heads to erase and record over the full width of the tape. Thus tapes recorded on the Model 401A may be played back on the Model 300 and Model 201 Recorders without pre-erasing the unused portion of the tape and without necessitating level adjustment.

Both the Model 400A and 401A will play back either full or half-track recordings made on any Ampex recorder.

CONTROLS-

Four buttons control the functions of Start (Play), Fast Forward, Rewind and Stop. A separate record button energizes the record relay, which drops out when the machine is stopped. Since the functions are relay operated, the control buttons may be placed at a remote location.

POWER INPUT REQUIREMENTS-

115 Volts AC 2 Amperes. Recorders are available for either 60 or 50 cycle operation. See serial number plate.

Manufactured by:

Ampex Electric Corporation
Redwood City, California

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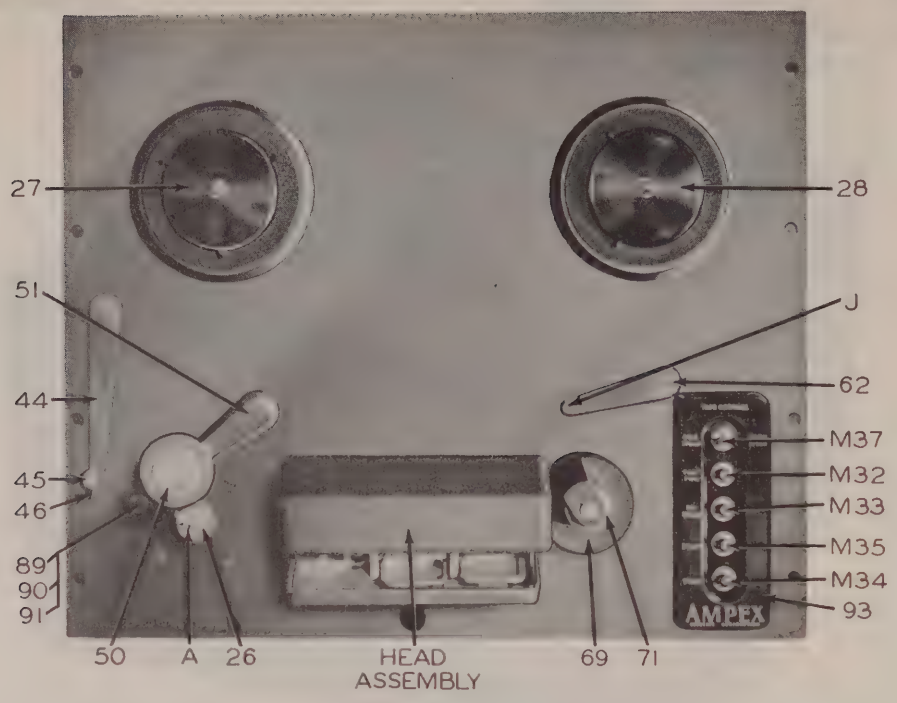

Figure 2

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SECTION I

SPECIFICATIONS

TAPE SPEED-

15 inches per second and 7.5 inches per second, with motor speed change and equalization switches conveniently located.

FREQUENCY RESPONSE-

At 15 inches ± 2db 50-15,000 cycles. At 7 1/2 inches ± 2db 70-10,000 cycles and down no more than 4db at 30 and 15,000 cycles.

SIGNAL-TO-NOISE RATIO-

Over 55db at both 7 1/2 inches per second and 15 inches per second, as defined by the N.A.B. standards. By definition, the signal-to-noise ratio is the ratio of peak recording level to the total unweighted playback noise when erasing a signal of peak recording level and in the absence of a new signal. Thus, bias and erase noise are included, as well as playback amplifier noise. All frequencies between 20 and 20,000 cycles are measured. The peak recording level is defined as that level at which the overall (input to output) total RMS harmonic distortion does not exceed 3% when measured on a 400 cycle tone.

STARTING TIME-

Instantaneous. (When starting, the tape accelerates to full speed in less than 1/10 second because the capstan motor operates whenever the power is on).

STOPPING TIME-

When playing at 15 inches per second, the tape moves less than 2 inches after the stop switch is operated.

FLUTTER AND WOW-

At 15 inches well under 2/10% RMS measuring all flutter components from 0 to 300 cycles using a tone of 3,000 cycles. At 7 1/2 inches per second under 1/4%.

PLAYBACK TIMING ACCURACY-

2/10%.

PLAYING TIME-

32 minutes at 15 inch speed with standard N.A.B. reel; 64 minutes at 7.5 inch speed (on each track). The standard R.M.A. reel may also be used on the tape supply turntable.

REWIND TIME-

Approximately one and a half minutes for a full N:A.B. reel.

PLUG-IN HEAD HOUSING-

Erase, Record and Playback Heads are contained in a single plug-in head housing.

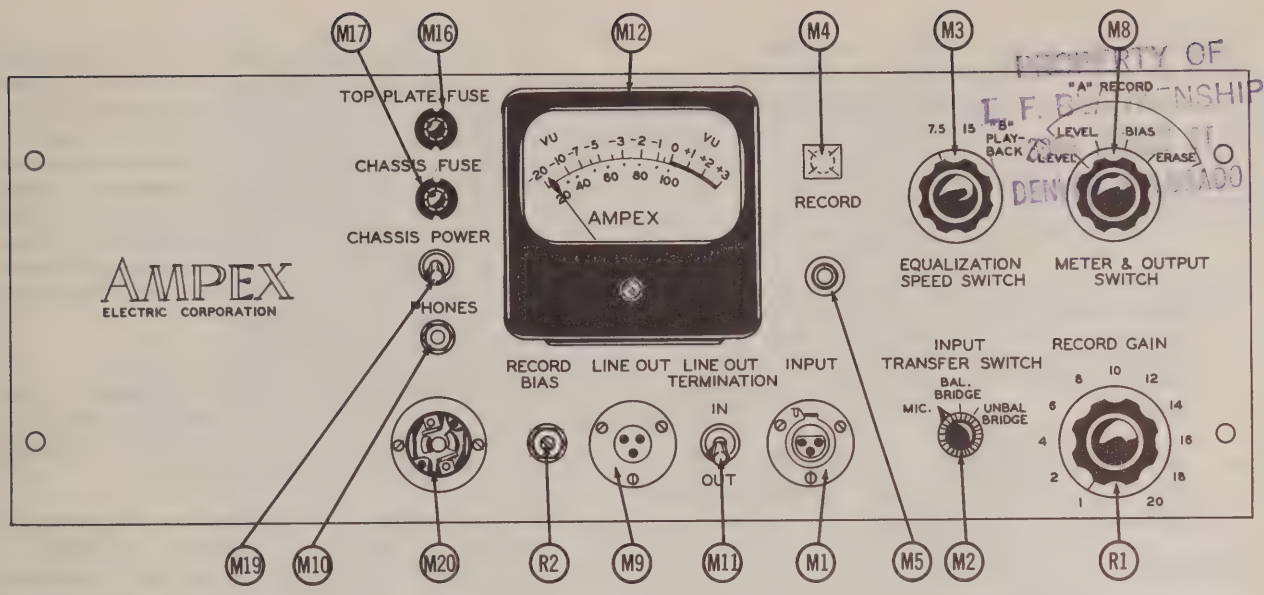


Figure 3

MONITORING-

Independent record and playback systems allow the tape to be monitored while recording.

INPUT-

A switch allows the recorder to accommodate either microphone level low impedance input or to bridge 600Ω plus 4 VU line balanced or unbalanced.

PLAYBACK AMPLIFIER-

Plus 4 VU output into 600Ω balanced or unbalanced.

METERING-

A 4 inch VU meter is mounted on the front panel and provides for:

a. Direct monitor of record input signal before or during recording.
b. Monitor of recorded output signal from playback head while recording or during playback.
c. Reading bias current.
d. Reading erase current.

PHONE MONITORING-

A phone monitor jack is provided for direct monitor of record input signal before or during recording and monitor of recorded output signal from playback head while recording or during playback. An A-B switch is incorporated in order that direct comparison can be made between the original program and the recorded program while a recording is being made. The same switch transfers the VU meter for level comparison and monitoring.

PLUG IN OF REMOTE CONTROLS-

The Model 400A and 401A are available with connectors installed in the Mechanical Assembly for "plug-in" of Remote Controls, the Model 375 60 Cycle Amplifier or Speed Lock Equipment.

MODEL 375 60 CYCLE AMPLIFIER-

The Model 375 Amplifier is a precision 60 cycle amplifier designed to provide a source of constant frequency to the capstan drive motor in localities where the available 60 cycle power is not stable in frequency

MODEL 380 SPEED LOCK EQUIPMENT-

The Model 380 Speed Lock Equipment is designed to automatically control the playback speed of the Model 400A Recorder to synchronize with motion picture equipment.

SECTION II

INSTALLATION

IMPORTANT-

Before attempting to operate the recorder, first read the following sections on Installation and Operation.

The portable machine is shipped in a ready-to-operate condition. All connections are readily accessable from the front panel. Release the front panel cover by unlatching and removing the top cover.

The rack mounted machine should be mounted on a standard 19" relay rack with the Mechanical unit above the main Electronic Panel. The Electronic Power Supply Panel should be mounted directly above the Mechanical Assembly, or at least 5" below the Electronic Assembly. Greater proximity to the Electronic Assembly will result in increased hum level.

If two 400A's or 401A's are to be mounted on a standard rack, the following placement is recommended (starting at the top of the rack):

1. Install a 13/4 inch spacer panel at the top of the rack.

2. Install below this panel the Mechanical Assembly for machine #1.
3. Install the Electronic Assembly for machine #1.
4. Install a 3/4 inch or 3 1/2 inch spacer panel.
5. Install the Mechanical Assembly for machine #2.
6. Install the Electronic Assembly for machine #2.
7. Install a 5 1/4 inch or 7 inch spacer panel
8. Install both Power Supply Panels at the bottom.
   (The cable on the power supply for the upper recorder will have to be extended in length).

NOTE: It is important that no Power Supply be closer than 5 inches to an Electronic Assembly.

I. AC POWER:

Connect the power cable, part #2413, from the AC Power Input Connector (M20) on the front panel of the Electronics Assembly to a source of 115 Volt AC power.

NOTE: This machine is available for either 50 or 60 cycle operation. The power line frequency is indicated on the serial number plate located on the Power Supply Panel for rack mounted machines and on the rear of the portable case for portable machines.

II. OUTPUT:

A. For Studio Line:
Plus 4VU, 600Ω line output, balanced or unbalanced, is available across Terminals 2 and 3 of the Line Out Connector, (M9). Pin 1 is the chassis ground. If unbalanced output is desired, tie either side of the line to ground. It is necessary to supply 600Ω termination to this output at all times in order to maintain correct meter calibration while recording or playing back. Therefore, if the output is not feeding a terminated line or if the output is not connected, such as on remote pickups, the Line Output Termination Switch, (M11), must be switched to In.

B. For Connection To High Impedance Amplifier Input:

Connect pin 3 of the line out connector (M9), to the high side of the amplifier input. Strap pins 1 and 2 of the connector and connect to the ground side of the amplifier input. The line output termination switch, (M11), must be left in the position designated "In" at all times, as explained in "For Studio Line", above.

III. INPUT:

A. Microphones:
Any low impedance microphone, the nominal impedance of which is in the range of 30 to 250Ω can be plugged in directly. Connect the microphone to pins 2 and 3 of the input connector, (M1). Connect cable shield to pin 1. Place the input transfer switch, (M2), in the "Mic" position.

The microphone input transformer is strapped for the optimum step up for a 150 to 250Ω source. In the case of microphones having 50Ω or less impedance, 6db additional gain can be obtained by strapping the input as shown in Figure 16B. This is not usually necessary, however, and should not be done unless insufficient gain is found to exist. If the input is re-strapped, serious frequency discrimination will exist should the input be fed from a source impedance greater than 50Ω.

IMPORTANT:
(R9) and (R10) will have to be changed to 24Ω to maintain a flat responce on balanced bridging when the transformer is strapped for 50Ω source impedance.

High impedance microphones are not recommended for use on this equipment. In general, the quality obtainable from high impedance microphones is not satisfactory for professional work. In the event that it becomes necessary to to connect a high impedance microphone, the input circuit will have to be rewired as shown in Figure 16A.

B. Bridging A Balanced Studio Line:
Connect a balanced line to pins 2 and 3 of the input connector (M1). Pin 1 is ground. Place the input transfer switch, (M2), in the Balanced Bridge position. Input levels of minus 10 to plus 10 VU can be accommodated. The load placed on the line is approximately 400,000Ω.

If the input transformer is re-strapped for 50Ω, the input level accommodated on the balanced bridge position is minus 4 to plus 16 VU.

For bridging higher or lower level lines, an external bridge can be wired in the line to the machine. This would consist of two resistors, the value of which should be from 15,000 to 50,000 times the RMS program voltage, in series with each side of the line. A 24Ω resistor should terminate each leg of the output side of the two bridging resistors. The junction of the two 24Ω resistors should go to chassis ground. The output of the bridge must be fed to the microphone input of the recorder. The input of the recorder may be connected for any impedance from 50 to 250Ω.

C. Bridging An Unbalanced Source:
Connect unbalanced line, radio tuner ect., to pins 3 and 1 of the input connector (M1). Pin 1 is the ground side. Place the input transfer switch (M2), in the unbalanced bridge position. This connection provides a 100,000Ω bridging input for any RMS program voltage greater than 1/2 volt. To increase the input impedance above 100,000Ω, a series resistance of 470,000Ω can be wired into the input plug in series with pin 3 and the input cable. This will necessitate an input voltage of at least 2 1/2 volts RMS. It is important that this resistor be physically placed in the cable connector that plugs into the recorder input (M1) in order that the cable capacity be on the input side of the resistor.

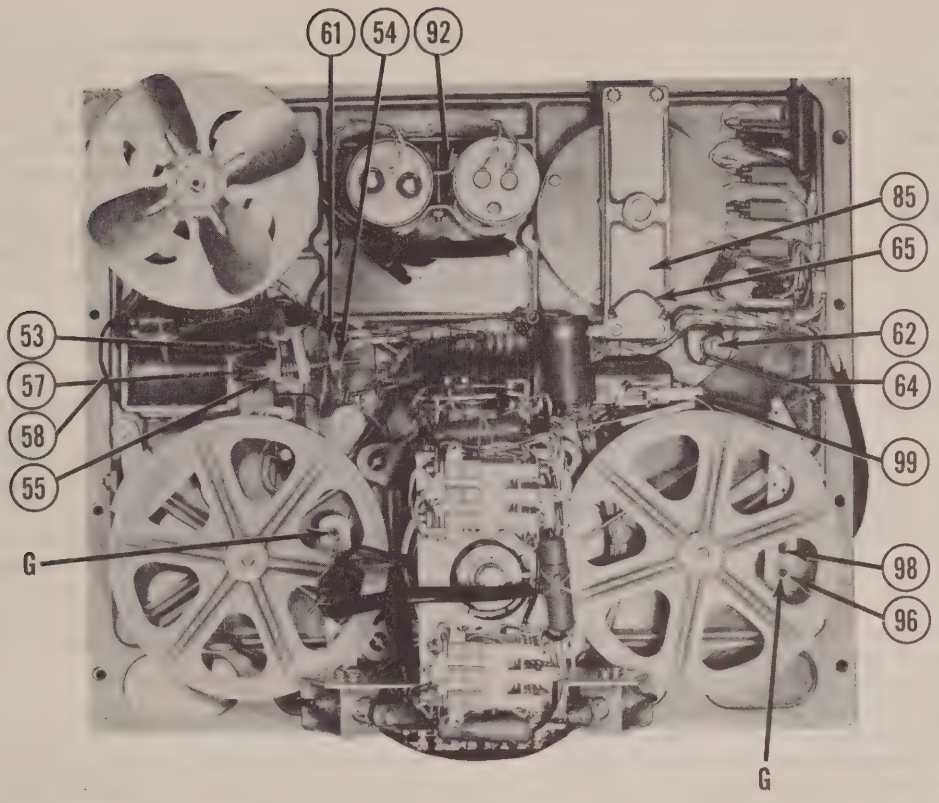


Figure 4

IV. PHONES:

Any sensitive high impedance head phones can be plugged in the phone jack (M10), provided for monitoring the incoming line or playback output.

VII. Conversion From Portable To Rack Mount:

If a portable or console recorder is converted to a rack mount, takeup tension arm counterbalance spring (65) must be added. This spring is supplied with the recorder and is hooked to the reel idler thrust bracket (85). To install, remove from bracket (85) and install between the lug provided on safety switch (M24) and the anchor (66) provided on the takeup tension arm collar (63). When shipped as a rack mount machine the spring will be installed. If the conversion is to be permanent, the oiling caps of the turntable motor (6), if equipped with sleeve bearings, should be rotated to be accessible for oiling.

SECTION III

OPERATING PROCEDURE

I. Reel Size:

The turntable on the left side (tape supply) is equipped to handle either the NARTB 10 1/2" reel of tape or the smaller R.M.A. 5" and 7" sizes. On portable machines position the small reels on the turntable engaging the turntable keys. For the large 10 1/2" reel, use the black plastic centering guide (catalog #976) that has been provided. On rack mount machine, use the hold-down knob (catalog #534) with both small and large reels. With small reels avoid excessive pressure when positioning the knob or the reel flanges will be distorted.

The turntable on the right side (Takeup Reel) is designed to handle only the NARTB 10 1/2" reel. No attempt should be made to use the small reel sizes on this turntable as the performance of the recorder will be seriously impaired.

II. Tape Threading:

Thread the tape as indicated in Figure 1. All new factory wound reels should be unwound and inspected by running through at Fast Forward before making a recording on the tape. New tapes are usually looped to the hub in such a manner that the tape will not come free of the reel at the end of the reel. This will prevent safety switch (M24) from disengaging the capstan idler (50) from capstan (A) which results in a flat being worn on the rubber capstan idler wheel. Any adhesive material accumulation on the reel hub must be removed with solvent for the same reason.

III. Half-Track Operation:

The handling of half-track tapes on this machine is accomplished in the following manner. The tape is threaded and operated as described under "Tape Treading" and "Tape Motion". However only the upper half of the tape will be used on the half-track machine. To utilize the lower half of the tape, the full reel on the Takeup Turntable should be removed, turned over and placed on the Tape Supply Turntable upside down. Place an empty reel on the Takeup Turntable. Repeat the operation as performed on the first track.

IV. Power:

Power is supplied through power switch, (M19), which must be turned on to operate the Electronics and Mechanical Assemblies. The Mechanical Assembly and Electronics Assembly are individually fused by the 2 ampere Control Circuit Fuse (M16) and the 1 ampere Electronics Fuse (M17).

V. Speed Switches:

There are two switches associated with operating speed. Speed Switch (M37) governs the motor and the Equalization Speed Switch (M3) corrects the equalization in the amplifiers.

VI. Tape Motion:

The tape motion is controlled by means of four pushbuttons labeled Stop, Start, Fast Forward, and Rewind.

1. Play Or Record:
The tape is set into Play motion at the speed selected by the Speed Switch (7 1/2"/Sec. or 15"/Sec.) when the Start Button (M35) is depressed. The tape must be completely stopped before starting in this position. To change from Play position to Record position with the tape in motion, press Record Button (M5).

2. Stop:
To stop the tape motion while it is moving in any mode press the Stop Button (M34). This will occur automatically if the tape should break or run off either reel.

3. Fast Forward:
If the tape is in the Play or Record mode, press the Fast Forward Button (M32). If the tape is stopped, first press the Start Button, then the Fast Forward Button or press both at the same time. This provides a Fast Forward speed which is used to arrive rapidly at a point within a reel.

4. Rewind:
If the tape is in the Play or Record mode, press the Rewind Button (M33). If the tape is stopped, press the Start Button then the Rewind Button or press both at the same time. This provides a fast reverse to rewind a tape completely or to return to an earlier section. In using either the Fast Forward or Rewind mode, it is desirable to remove the tape from direct contact with the heads by opening the gate of the Head Assembly. This will reduce wear on the heads and prevent the oxide coating on the tape from depositing on the heads and impairing their performance. It is not possible to switch from Rewind to Fast Forward or vice versa unless the machine is returned to Stop. Interlocking the machine in this manner provides the least possible wear on the Tape Transport System.

Indexing the tape as in editing or cueing or when approaching the end of the reel is simplified by holding down a combination of buttons. Hold down the Stop and Fast Forward or the Stop and Rewind Buttons. Now press the Start Button and control the tape speed with this button.

CAUTION: Avoid this operation at high speeds, as it will result in tape breakage if the wrong combination of buttons should be pushed. When the tape is traveling at high speed in the Rewind or Fast Forward mode, the tape will break if the Stop and Start Buttons are pressed in rapid sequence. This is caused because sufficient time is not allowed for the brakes to stop the tape before the Capstan Idler locks the tape to the Capstan.

VII. Playback:

To play back a previously recorded tape, turn the Meter and Output Switch, (M8), to the extreme left position designated Playback. Then start the tape in motion as indicated under "Play". If the recording was made at the correct level, the VU Meter will peak on 0 (zero). No attempt should be made to alter the gain of the Playback Amplifier if the meter does not peak on 0 (zero). Otherwise, the calibration of this meter as a record level indicator will be destroyed. The playback gain will be close when playing any tape recorder to N. A. B. specifications at 15"/Sec.

VIII. Record:

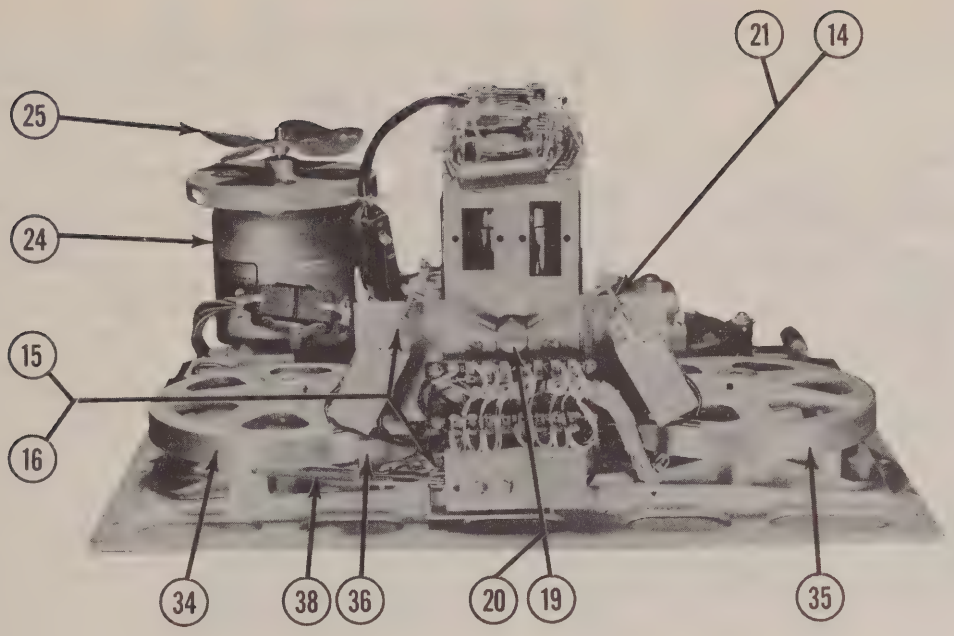
To record a new program on previously recorded tape, or on blank tape, turn the Meter and Output Switch to the Second position from the left which is designated Record Level. Turn the Record Gain Control clockwise until the level reads 0 (zero) on the VU Meter on the most intense program peaks. The program can be audibly monitored through either the Phone Jack or the Line Out Connector before the tape is in motion. (For correct meter calibration it is important that the Line Out be properly terminated either external to the machine or by use of the Line Output Termination Switch). This direct monitor feature allows the program to be set up through the machine without actually recording during the set up period.

When the program level is properly set, start the tape in motion as indicated under "Play". Then push the Record Button. (Be sure there is a delay of at least 1/2 second before operating the Record Button, as the surge from operating the Start Button may magnetize the record head, thereby increasing the noise level on the tape). The Record Indicator above the Record Button will now glow and the machine is recording.

It is desirable to check the record bias and erase currents occasionally. In order to do this, reposition the Meter and Output Switch to the positions designated Bias and Erase, respectively. The erase is not critical and should read approximately zero on the meter scale. The bias should read between - 1/2 and + 1/2 on the VU scale. The bias is somewhat critical and must be kept within the indicated range in order to record the higher frequencies at 7 1/2 inch tape speed.

The bias is adjusted by means of the locked Bias Control (R2). The meter calibration for bias measurement can be checked as described under "Tape Motion" (VI.).

An actual comparision of the recording with the direct program can be made both audibly and on the



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3934 MEADE ST.
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Figure 5

VU Meter by moving the Meter and Output Switch to the extreme left position for playback monitor, and then to the second from the left position for monitor of the unrecorded program. The levels as read on the meter and the quality as heard will be the same within the tolerances of the machine. It should be noted that some change in level as read on the VU Meter while switching from A to B will be experienced if a tape of different manufacture than the one used to set up the machine is used.

When the program being recorded is finished, press the Stop Button. The Tape Transport will stop and the Record Relay will drop out, making the record circuits inactive. The record circuits will remain inactive until the Record Button is again depressed while the tape is moving in the Play mode.

NOTE: Because of the extremely wide frequency range of the VU Meter, some pickup of the erase and bias frequency will be experienced while monitoring the record or playback level while recording. The pickup of this oscillator frequency (approximately 100KC) can be read on the VU Meter approximately 20db below the program level, but does not interfere in any way with the performance of the machine.

SECTION IV

OPERATING THEORY

I. Mechanical Assembly:

To understand the operation of the Tape Transport Mechanism it is necessary to examine the following assemblies in the various modes of operation:

1. Capstan Drive Motor (24), Figure 5.
The capstan motor is a synchronous motor whose extended shaft forms the tape drive capstan (A) Figure 2. It has two sets of windings to provide the two tape speeds.

2. Turntable Motor (6) Figure 6.
The turntable motor is an induction motor which drives either the Tape Supply or Takeup Turntable by means of a Rubber-tired Pulley (7) on its shaft. The motor is positioned to contact either of the turntable Brake Drums (34 and 35), Figure 5, by the Tilt Solenoids (M43 and M44).

3. Capstan Idler (50), Figure 2.
The capstan idler is positioned by the Capstan Solenoid (M41). In the Play mode of operation the Idler is positioned against the Capstan (A) and drives the tape at a constant speed.

4. Stopping Brakes (36 and 39) Figure 5 & 8.
The Stopping Brakes are solenoid operated to stop the turntables whenever the machine is stopped.

5. Reel Idler (69), Figure 2.
The Reel Idler is provided to smooth out any takeup speed variations in the tape system.

6. Takeup Tension Arm (62), Figure 2.
The Takeup Tension Arm provides automatic stop at the end of the reel of tape or if the tape should break.

7. Constant Tension Brake (47), Figure 8.
The constant tension brake is mechanically operated by the constant tension arm (44), Figure 2. It provides constant hold-back tension to the tape supply turntable (27), regardless of the amount of tape on the reel or its size.

When the Power "On-Off" Switch (M19) is thrown, AC voltage is applied to the Electronics Assembly and to the Capstan Motor. Therefore, the Capstan is turning whenever the recorder is turned on, which makes possible the fast start feature. When the tape is threaded the Safety Switch (M24) is actuated by the takeup tension arm (62). This energizes the DC Power Supply which in turn provides power to operate the solenoids and relays.

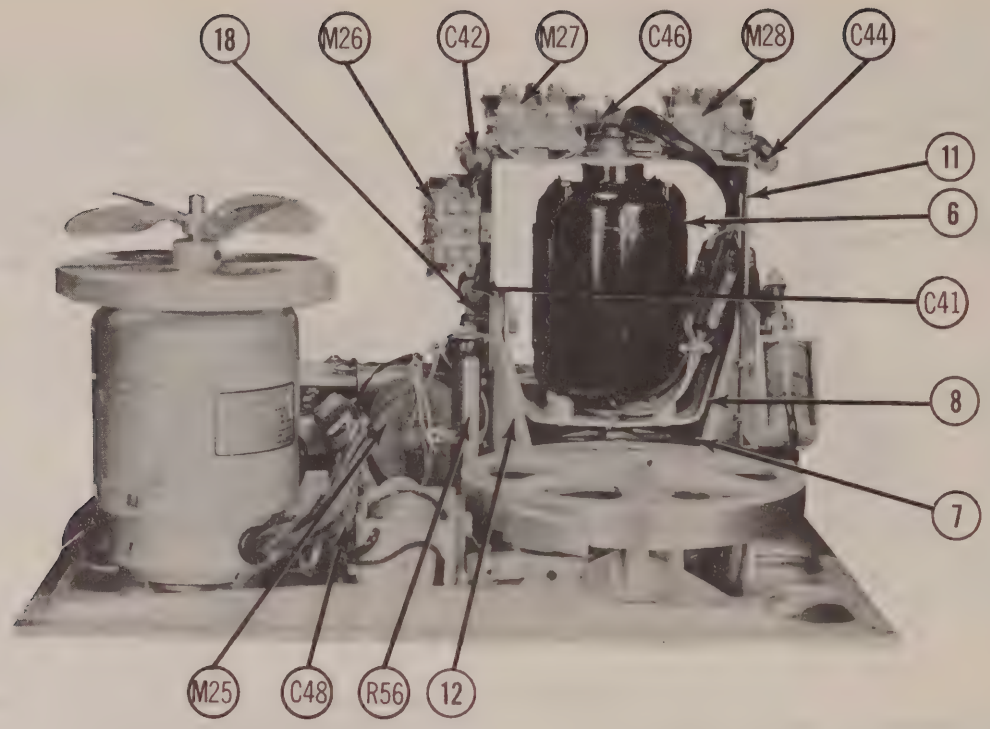

Figure 6

Start:

When the Start Button (M35) is pressed the Start Relay (M26) will be energized. It is held energized through its own contacts and the normally closed Stop Button (M34). The Start Relay, through appropriate interlocks, performs the following functions:

1. Energizes the Brake Solenoid (M42) thus releasing the Stopping Brakes (36 and 39).
2. Energizes the Forward Tilt Solenoid (M44) thus positioning the Turntable Motor in the takeup position.
3. Applies AC power through the Takeup Torque Switch (M40) to the Turntable Motor.
4. Energizes the Capstan Solenoid (M41) which positions the Capstan Idler (50) to contact the tape and the Capstan.

The Capstan Solenoid when energized mechanically opens the Takeup Torque Switch which inserts a resistor (R56) in series with the Turntable Motor. This allows the high starting torque to be reduced to a more suitable value for operating conditions. (Full power is utilized in Fast Forward or Rewind). The recorder is now operating in the Play mode of operation with the tape moving at the speed selected by the Speed Switch (M37).

Fast Forward:

If the Fast Forward Button (M32) is pressed and the machine is in the Play mode of operation, the Fast Forward Relay (M27) will be energized. The relay performs the following functions:

1. It interlocks the Rewind Relay (M28) so it can not be energized.
2. If breaks the circuit to the Capstan Solenoid.

When the Capstan Solenoid is de-energized the Takeup Torque Switch closes, thus applying full power to the Turntable Motor. Since the Forward Solenoid is still energized the machine is now operating in the Fast Forward mode of operation. If the Rewind Button is pressed nothing will happen and it is necessary to return to Stop before the mode of operation can again be changed. This interlocking prevents scuffing the Turntable Motor Tire on the Brake Drums.

Rewind:

If the Rewind Button (M33) is pressed and the machine is in the Play mode, the Rewind Relay (M28) will be energized. The relay performs the following functions:

1. It interlocks the Fast Forward Relay (M27) so it can not be energized.
2. It breaks the circuit to the Capstan Solenoid (M41) and the Forward Tilt Solenoid (M44).
3. It energizes the Rewind Tilt Solenoid (M43) thus positioning the Turntable Motor in the Rewind position.
4. It reverses the polarity on one winding of the Turntable Motor thus reversing its direction.

When the Capstan Solenoid is de-energized the Takeup Torque Switch closes applying full power to the Turntable Motor. The machine is now operating in the Rewind mode of operation. If the Fast Forward Button is pressed nothing will happen and it is necessary to return to Stop before the mode of operation can again be changed.

Stop:

When the Stop Button is pressed during any mode of operation, the Start Relay will be de-energized. This in turn breaks the circuits to the Rewind and Fast Forward Relays and to the circuits described in the paragraph on Start. The Stopping Brakes will be applied to both turntables. In addition it ap-

plies DC power through a series resistor (R55) to the capacitor winding on the Turntable Motor. This brakes the motor and prevents throwing a tape loop when the tape direction is changed.

II. Head Assembly:

The Head Housing is a die cast assembly which contains the three heads used in the recording process. The heads are respectively Erase, Record and Playback as viewed from left to right when facing the machine. The gate on the housing holds the Playback and Record Shield Covers and the Tape-lifting Fingers. The function of the Tape-lifting Fingers is to remove the tape from the heads when the gate is open during Rewind or Fast Forward position. This reduces head wear considerably. The tape may leave a deposit on the heads if allowed to contact them at high speeds. Such a deposit will seriously impair the performance of the machine and should be guarded against by always opening the gate on Fast Forward and Rewind. If a deposit is left, it may be easily removed with carbon tetrachloride on a soft rag. Never use metal of any kind to touch the head surfaces. The gate should never be allowed to spring shut but should be closed gently.

The Model 400A Recorder incorporates half-track Erase, Record, and Playback Heads. These heads function on the upper half of the tape only. In order to use the remaining half of the tape the reels must be turned over as explained in paragraph on "Half Track Operation". The Head Assembly of the Model 401 Recorder incorporates full track Erase and Record Heads thus producing tapes interchangeable on any full track equipment. A half track Playback Head is still used on this machine and provides adequate playback on both full track and half-track tapes.

III. Electronics Assembly:

The Electronic Assembly of the Model 400A Recorder consists of a Record Amplifier, a Playback Amplifier and an Erase and Bias Oscillator on one chassis and a Power Supply on a seperate chassis.

The Record Amplifier is a four stage, high gain amplifier that feeds the Record Head through the Noise Balance Circuit and Record Relay (M6). The Record Relay is energized by the Record Button (M5) through contacts of the Start Relay (M26) in the energized position and contacts of the Fast Forward Relay (M27) and the Rewind Relay (M28) in de-energized positions. Therefore the Record mode of operation can only be realized when a tape is traveling at the Play speeds. Whenever the Fast Forward, Rewind or Stop Buttons are depressed, the Record Relay will be de-energized. Three input impedances can be selected by the Input Transfer Switch (M2); low impedance microphone, balanced bridge and unbalanced bridge. The Record Amplifier also provides seperate high frequency pre-emphasis for each speed. This change in equalization is made by the Equalization Speed Switch (M3) located on the front panel. The Record Gain Control (R1) is located on the front panel.

The Playback Amplifier is a three stage amplifier which provides plus 4 VU 600Ω output at the Line Out Connector (M9). The playback equalization is the same for both speeds and is adjusted to a standard curve by (R5), located on top of the Electronics Chassis. The playback gain is controlled by (R4) also located on top of the Electronic Chassis. An output termination is provided by the Line Out Termination Switch (M11).

Monitoring is provided by a VU Meter and a Phone Jack connected to the Playback Amplifier output. The Meter and Output Switch provides four monitoring checks: Playback Level, Record Level, Bias Current and Erase Current. In the Erase position the VU Meter is connected across the 7Ω resistor (R52) to read erase current. In the Bias position the meter is connected across the adjustable 500Ω resistor (R3) to read bias current. In both the Record and Playback Level positions the meter is connected across the Playback Amplifier output. In the Playback position the Playback Amplifier functions normally and the output of the tape is monitored. In the Record position the last two stages of the Playback Amplifier are disconnected from the first stage and bridged across the Record Amplifier before pre-emphasis through the Record Level Meter Calibration Control (R7). The Calibration Control is adjusted so that the meter will read the same when monitoring either playback or record.

The Erase and Bias oscillator provides the 100 KC erase and bias frequency. It feeds the erase head through the Erase Trimmer (C33) located on the top plate of the Electronics Chassis. It feeds the record head through the Record Bias Control located on the front panel. The Power Supply provides the 6.3 Volt AC heater power, the 12.6 Volt DC heater power through Full Wave Selenium Rectifier (M21) and the 350 Volt plate supply through the 5Y3G Full Wave Rectifier (V10).

SECTION V

ROUTINE MAINTENANCE

I. Cleaning:

The Tape Transport Mechanism should at all times be kept clean and dry. The following parts should be inspected daily before the use of the recorder and cleaned with a soft rag and carbon tetrachloride or alcohol, if necessary. Refer to Figure 2.

1. Head surfaces contacted by tape.
2. Capstan (A).
3. Capstan Idler (50). Cleaning is required only if foreign matter should adhere to the rubber.
4. Capstan Tape Guide (89).
5. Constant Tension Arm Tape Guide (45).
6. Reel Idler Pulley (71).
7. Takeup Tension Arm Tape Guide (J).

II. Head Demagnetization:

Occasionally the heads may become magnetized through an electrical fault in the amplifiers, improper use of the machine, or by the heads coming in contact with a magnetized object. This will result in an increase of noise level from 5 to 10db. It is especially important that the heads be free of magnetization if you are to realize the dynamic range of the machine. It should be remembered that any phenomena that tends to put an unbalanced pulse through the Record Head will magnetize it. Such pulses can appear in the form of signal or power line pulses. If the following pre-

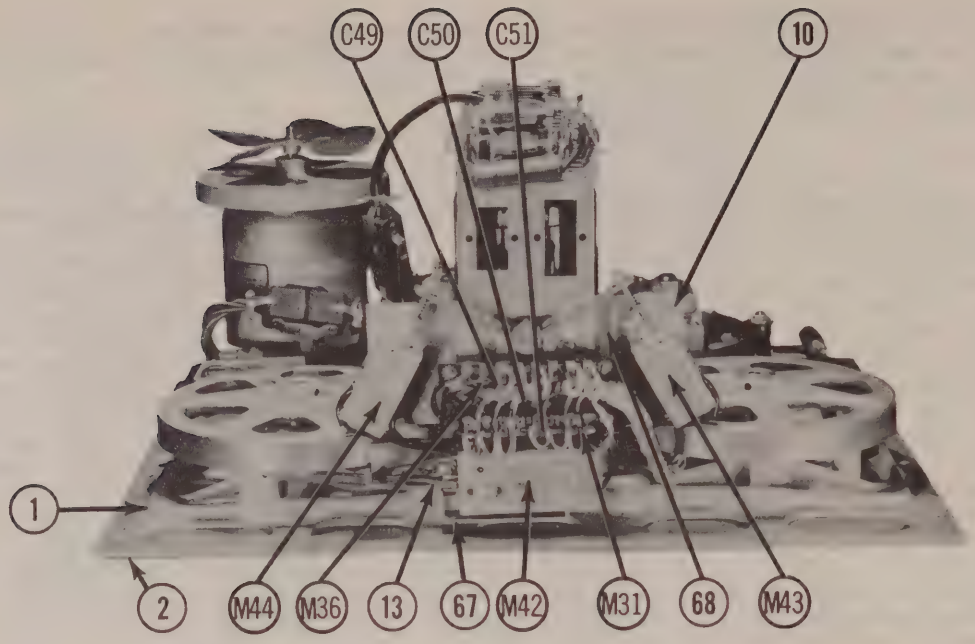

Figure 7

cautions are observed, no difficulty should be experienced:

1. Do not remove any tube from the Record Amplifier while the machine is recording.
2. Do not connect or disconnect input leads or head leads while recording.
3. Do not depress the Record Button until after depressing the Start Button. In other words, allow the transient caused by switching the motors and solenoids to die out before the record head is connected. A one-half second pause is sufficient.
4. Do not saturate the Record Amplifier with an abnormally high input signal. Such a signal would be 10db greater than tape saturation or approximately 30db greater than normal operating level.
5. Do not test continuity in the heads with an ohm meter. Should the heads become magnetized, they can be demagnetized with an Ampex Head Demagnetizer (catalog #704). The following Demagnetization Procedure should be performed: Bring the tip of the Demagnetizer in direct contact or close proximity to the head core stack. Run the tip of the Demagnetizer up and down the entire height of the core stack three or four times. Remove the demagnetizer very slowly, allowing the AC field to die off gradually. Repeat this operation on Record and Playback Heads only, as the Erase Head will demagnetize itself. In the event demagnetization is not effected, repeat the process several times.

III. Capstan Magnetization:

The Capstan (A) may become magnetized by contact with a magnetized tool. Capstan magnetization appears as noise components usually occuring at the rotational period of the Capstan. They will be present on the playback of a tape only and will not be heard when monitoring a tape during the recording process because they will be erased by the Erase Head. Should this magnetization occur it may be removed with an AC solenoid placed over the shaft and slowly pulled away.

IV. Lubrication:

The following places require lubrication once or twice a year depending upon the amount of usage of the machine:

1. Capstan Drive Motor (24).
The Upper Sleeve Bearing on this motor requires lubrication. Pry off the Capstan Dust Cap (26). The oil hole on the motor is located near the outside edge of the cutout and in some cases may be partially obscured. Lubricate with 10 drops of SAE 20 motor oil preferably using an oil can with a flexible spout.

2. Turntable Motor (6).
The Recorder may be equipped with different types of turntable motors. If the Turntable Motor has oil cups, it requires 10 drops of SAE 20 motor oil in each cup. Raise the front of the Tape Transport Top Plate to expose the oil cups. On portable machines, it is necessary to slide out the Electronic Assembly and loosen the head cable clamp before the Tape Transport Mechanism can be raised. If the motor is supplied with ball bearings (no oil cups), lubrication is not required.

3. Reel Idler Upper Bearing (72).
Remove the Plug Button (74) and lubricate with one drop of SAE 20 motor oil.

The following places have been lubricated at the factory with Dow-Corning DC-44 Silicone Grease (light consistency). No further lubrication should be necessary unless the grease becomes contaminated with dirt in which case the part should be cleaned and relubricated.

1. Capstan Idler Arm Bushing (4).
2. Constant Tension Arm Bushing (5).
3. Capstan Solenoid Eye Bolt (54).
4. Reel Idler Thrust Bearing (86).
5. Safety Switch Lever (M24).

The Takeup Tension Arm Bushing (3) has been lubricated at the factory with Dow-Corning DC-200 oil. No further lubrication should be necessary unless the oil becomes contaminated with dirt in which case the part should be cleaned and re-lubricated. If DC-200 oil is not available SAE 20 motor oil can be used.

The following places require no lubrication and should be left dry:

1. Brake Shoe pivot on the Constant Tension Brake (47).
2. The armatures of all solenoids.
3. Brake Solenoid Link (13).
4. Tilt Solenoid Spade Bolts (14).

V. Brake Lining:

Periodic inspection should be made of the Brake Linings on the Stopping Brakes (36 and 39). Constant Tension Brake (47) and the Hold Back Brake (22), as worn linings will result in damage to the surface of the Brake Drums. These linings are made of high grade felt but they may require replacement after long service. The linings are supplied by the factory cut to size.

The recommended method of applying Brake Lining is described below:

1. Remove both Brake Drums (34 and 35) as described under "Turntable and Brake Drum Height".
2. Remove old lining and scrape the shoe clean. It is not necessary to remove the brakes to do this.
3. Spread a liberal amount of DuPont Household Cement or equivalent on the brake shoe; excessive cement should be avoided as it will soak through the Brake Lining.
4. Position the felt carefully so it lines up with the outside edges of the shoe and allow at least 30 minutes for cement to dry.

CAUTION: Be sure that cement is not allowed to remain on working surfaces.

5. Replace the Brake Drums and adjust the turntable and Brake Drum height as described under "Turntable and Brake Drum Height". A number of stops may be necessary to bring the stopping energy of the brakes up to normal. Sanding the Brake Drums as described in "Adjustment of Braking System" will hasten this process. Do not touch the surface of the Brake Drum after sanding.

In an emergency any good quality 100% wool felt may be cut to size and used as linings. They should, however, be replaced as soon as possible with factory linings.

SECTION VI

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MECHANICAL SERVICE GUIDE

This section is a guide to locating irregularities in the operation of the Tape Transport Mechanism of this recorder. Sources of irregularities in the Electronic Assembly have not been included in this folder since standard electronic maintenance techniques apply. This section is divided into the following four parts:

I. Failure To Start.

II. Irregularities In Play Mode.

III. Irregularities In Rewind Or Fast Forward Mode.

IV. Miscellaneous.

To use this section first decide into which of the above groups the trouble lies. Check the list of symptoms in the group to further localize the trouble. Investigate each of the parts listed under the appropriate symptoms to detect incorrect adjustment or possible defects. Refer to Section VII for the correct mechanical adjustment procedures.

I. Failure To Start:

A. Capstan Drive Motor inoperative at one or both speeds. Check the following:

1. AC Power to the recorder.
   a. Control Circuit Fuse (M16).
   b. Power Cable from Mechanical Assembly to Electronic Assembly.
   c. Capstan Drive Motor Connector (M38).
   d. Speed Change Switch (M37).
   e. Jumpers from 1 to 2 and 3 to 4 on 60 Cycle Amplifier Terminal Strip (M31).

NOTE: Machines equipped for "plug in" of 60 Cycle Amplifier must have properly jumpered Dummy Plug (catalog #567) inserted in the 60 Cycle Amplifier Connector in absence of the 60 Cycle Amplifier.

2. Head cables interfering with Drive Motor Flywheel.

3. Capstan Drive Motor (24) for binding of shaft, open or shorted winding.

4. Drive Motor Capacitor (C47).

B. Machine does not operate or trips itself off when Start Button is depressed.

NOTE: Before making these checks read Section III-II on Tape Threading. Check the following:

1. Switches.
   a. Safety Switch (M24). For adjustment, See Section VII-10.
   b. Stop Button (M34).
   c. Start Button (M35).

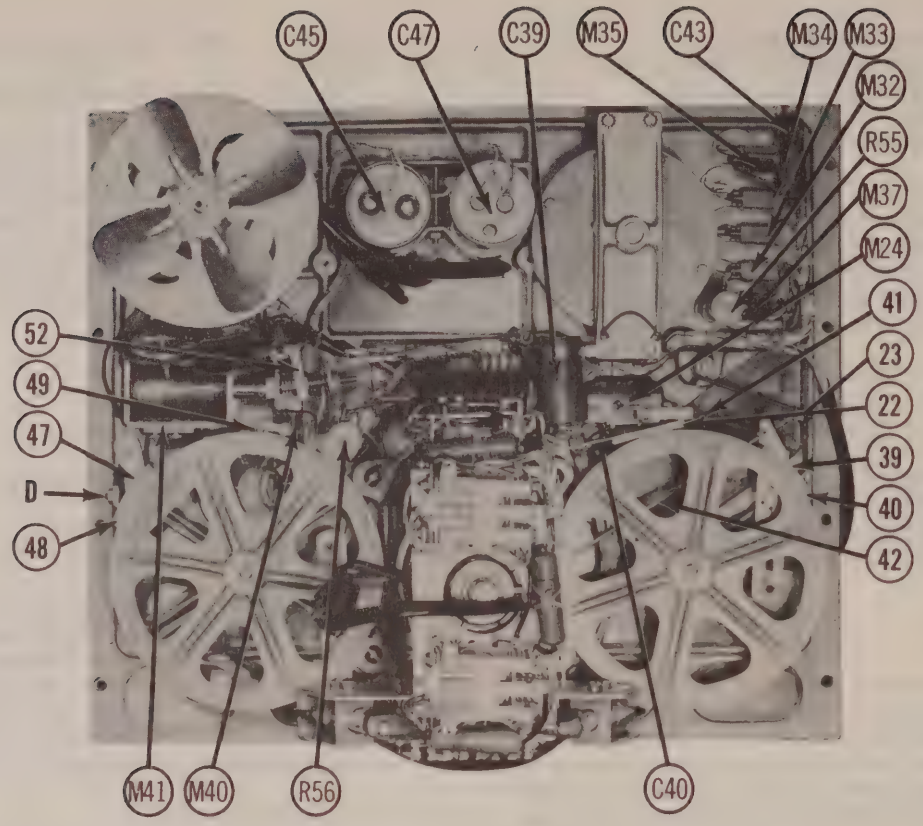

Figure 8

d. Takeup Torque Switch (M40). For adjustment, see Section VII-7.

2. DC Relay and Solenoid Power Supply.
   a. Selenium Rectifier (M25).
   b. Resistor (R54).
   c. Electrolytic Capacitor (C39).

3. Relays.
   a. Start Relay (M26).
   b. Rewind Relay (M28).
   c. Fast Forward Relay (M27).

4. Solenoids.
   a. Capstan Solenoid (M41). For adjustment, see Section VII-1.
   b. Forward Tilt Solenoid (M44). For adjustment, see Section VII-8.
   c. Brake Solenoid (M42). For adjustment, see Section VII-2.

5. Play Resistor (R56) for an open circuit.

6. Jumper from Terminal 7 to 8 on the Remote Control Terminal Strip (M36).

NOTE: Machines equipped for "plug in" of Remote Control must have the properly jumpered Dummy Plug (catalog #3461) inserted in the Remote Control Connector in absence of a Remote Control System.

7. Binding of Turntable Motor Pivots (18) and (19).

8. Cables interfering with the Brake Drums (34) and (35).

9. Counterbalance Spring (65) in rack mount position on portable machines. See Section II-VII.

II. Irregularities In Play Mode:

A. Unsatisfactory starting in Play Mode. Check the following:

1. Takeup Torque Switch (M40) for adjustment. (May be opening too early). See Section VII-7.

2. Binding of Turntable Motor Pivots (18) and (19) may cause late engagement of Turntable Motor.

3. Tilt Solenoids (M43) and (M44) if misadjusted can cause slippage or late engagement of Turntable Motor. See Section VII-8.

4. Insufficient takeup torque in the Play mode.
   a. Play Resistor (R56) set too high. See Section VII-9.
   b. Cable interfering with Takeup Brake Drum (35).

5. Stopping Brakes (36) and (39).
   a. Dragging brakes.
   b. Brake Clearance adjustment too great so that brakes are slow in releasing. See Section VII-2.

6. Capstan Idler Pressure adjustment. See Section VII-1.

7. Takeup Tension Arm (62) sluggish.

8. Constant Tension Brake (47) adjustment. See Section VII-3.

9. Low relay and solenoid supply voltage which would slow down the relay and solenoid operation time.

B. High flutter. The low flutter specifications on this equipment are rigidly met. Any noticable flutter can probably be traced to one of the following:

1. Cable dragging on:
   a. Takeup Brake Drum (35).
   b. Reel Idler Flywheel (78).
   c. Capstan Drive Motor Flywheel.

2. Foreign material such as a deposit left by the tape on:
   a. Capstan (A), Figure 2.
   b. Reel Idler Pully (71), Figure 2.
   c. Capstan Idler (50), Figure 2.
   d. Turntable Motor Tire (7), Figure 6.
   e. Takeup Brake Drum (35), Figure 5.
   f. Head Surfaces.
   g. Tape Guides (45), (89), and (J), Figure 2.

3. Excessive drag in Reel Idler (69). If Reel Idler is quiet and turns freely it is not likely to contribute to the flutter and should not be disassembled. If the Reel Idler will not turn freely or is noisy, check the following. Refer to Figure 9.
   a. Reel Idler Adjustment. See Section VII-6.
   b. Top Bearing (72) insufficiently lubricated. See Section V-IV.
   c. Thrust Bearing (86) worn.
   d. Foreign material in Lower Bearing (75).

4. Capstan Drive Motor (24).
   a. Top Bearing insufficiently lubricated. Do not over-lubricate. See Section V-IV.
   b. Bent Capstan (A).
   c. Motor windings partially open or shorted.

5. Capstan Idler (50) defective.

6. Takeup Torque Switch (M40) (not opening). See Section VII-7 for adjustment.

7. Bad Tape (worn, ragged, or of poor quality).

8. Recorder subjected to excessive external vibration.

C. Recorder fails to shut off when tape runs out. Check the following:

1. Takeup Tension Arm (62) sluggish due to:
   a. Dirt between Takeup Tension Arm (62) and Bushing (3).
   b. Takeup Tension Arm Return Spring (64) disconnected or broken.
   c. Safety Switch (M24) inoperative or out of adjustment. See Section VII-10.
   d. Safety Switch Capacitor (C40) shorted.

D. Instability of Tape on Capstan. Check the following:

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1. Oil on Capstan (A) or Capstan Idler (50).

2. Takeup Torque Switch (M40) not opening causing excessive takeup tension. See Section VII-7 for adjustment.

3. Capstan Idler Pressure Adjustment. See Section VII-1.

4. Capstan Solenoid (M41) (not seating).

5. Constant Tension Brake Spring (49) disconnected or broken.

6. Constant Tension Arm (44) binding in Bushing (5).

7. Bad Tape (stretched edges or bad splices).

E. Recorder goes into Fast Forward Mode when Start Button is depressed. Check the following:
1. Capstan Idler Pressure Adjustment. See Section VII-1.

2. Capstan Solenoid (M41) for defect.

III. Irregularities In Fast Forward Or Rewind Mode.

A. Recorder stops when Fast Forward or Rewind Buttons are depressed. Check the following:

1. Fast Forward Button (M32).

2. Rewind Button (M33).

3. Fast Forward Relay (M27).

4. Rewind Relay (M28).

5. Rewind Tilt Solenoid (M43). For adjustment, See Section VII-8.

B. Recorder sluggish in Fast Forward or Rewind. Check the following:

1. Takeup Torque Switch (M40) (stays open), See Section VII-7 for adjustment.

2. Cable Dragging on either Brake Drum (34) or (35).

3. Stopping Brakes (36) and (39).
   a. Dragging Brakes.
   b. Brake Solenoid (M42) loose or inoperative. See Section VII-2.

4. Turntable Motor (6) for insufficient lubrication. See Section V-IV.

5. Slippage between Turntable Motor Tire (7) and Brake Drums (34) or (35).

a. Tilt Solenoid (M43) and (M44). For adjustment See Section VII-8.
b. Oil on Brake Drums (34) or (35) or Turntable Motor Tire (7).
c. Binding of Turntable Motor Pivots (18) and (19).

IV. Miscellaneous Irregularities.

A. Braking too severe causing breaking or deformation of tape.

1. Binding of Brake Arm Pivot, Figure 4 point G. See Section VII-2A for adjustment.

2. Brake Solenoid Stop (67) deformed. See Section VII-2E.

B. Braking insufficient causing tape slack to be thrown when the machine is stopped.

1. Brake Drum contaminated with oil or grease. See Section VII-2F for cleaning procedure.

C. Braking rotationally uneven.

1. Brake Drum contaminated with oil or grease. See Section VII-2F for cleaning procedure.

SECTION VII

MECHANICAL ADJUSTMENTS

The mechanical adjustments described below have been made at the factory prior to shipment of the machine. No further adjustments should be necessary except as required by routine maintenance if irregularities should occur in the operation of the machine.

CAUTION: When returning the Mechanical Assembly to the portable case after making adjustments, make sure the cables do not interfere with moving parts.

The following mechanical adjustments are described:

1. Capstan Idler Pressure Adjustment.
2. Adjustment of Braking System.
3. Constant Tension Brake Adjustment.
4. Turntable and Brake Drum Height.
5. Rewind Holdback Brake Adjustment.
6. Reel Idler Adjustment.
7. Takeup Torque Switch Adjustment.
8. Forward and Rewind Tilt Solenoids Adjustment.
9. Play Takeup Torque Adjustment.
10. Safety Switch Adjustment.

1. Capstan Idler Pressure Adjustment.

The Capstan Idler (50) is positioned to contact the Capstan (A) by the Capstan Solenoid (M41). The pressure is adjusted by a lock nut on the Capstan Solenoid Eye Bolt (54). Tightening this nut causes greater pressure until a point is reached where the Capstan Solenoid will not seat or bottom. At this point the pressure is very low and the nut must be backed off. Excessive pressure should also be avoided as it throws unnecessary load on the Upper Drive Motor Bearing.

The recommended method for adjusting this solenoid is to take up on the adjusting nut until the Capstan Idler (50) just touches the Capstan (A) when the Capstan Solenoid (M41) is bottomed. Then turn the nut an additional 21/2 turns.

CAUTION: Make sure the solenoid will bottom after this adjustment. If not the solenoid or linkage is defective. When adjusted as above, sufficient drive force exists under all operating conditions to prevent tape slippage unless the Capstan Idler should become contaminated with oil or foreign matter.

2. Adjustment of Braking System.

The braking system in this machine is designed to retain its adjustments over extremely long periods of time. The following explanation and adjustment information will be of value if it becomes necessary to replace parts in the braking system or to clean the Brake Drums.

It is necessary that each reel have considerably more braking force in one direction than the other. This is often referred to as "brake differential". The braking force can be easily measured by attaching a piece of string about 30 inches long to the hub of an NARTB reel, the other end being attached to a spring scale (0 to 64 oz. preferred). Wind the string around the hub and pull the scale evenly. Take the reading only while the turntable shaft is in steady motion as the force required to overcome the static friction of the system will be considerably higher than that of the actual braking force. Most scales when operated in a horizontal plane will show a zero setting different from the normal scale zero. The scale readings should be corrected accordingly. In measuring forces on the Tape Supply Reel, hold the Constant Tension Arm (44) firmly in the direction of the Capstan (A) as this is also a brake and should not be included in the reading of Tape Supply braking force.

The following braking forces are optimum:

Tape Supply Reel (with Constant Tension Arm held "off")

Clockwise	3 oz. $\pm$ 1 oz.
Counterclockwise	18 oz. $\pm$ 2 oz.

Takeup Reel

Clockwise	28 oz. $\pm$ 3 oz.
Counterclockwise	8 oz. $\pm$ 1 oz.

The following adjustments should be performed in the sequence indicated if a part in the braking system is replaced.

A. Brake Arm Pivot.

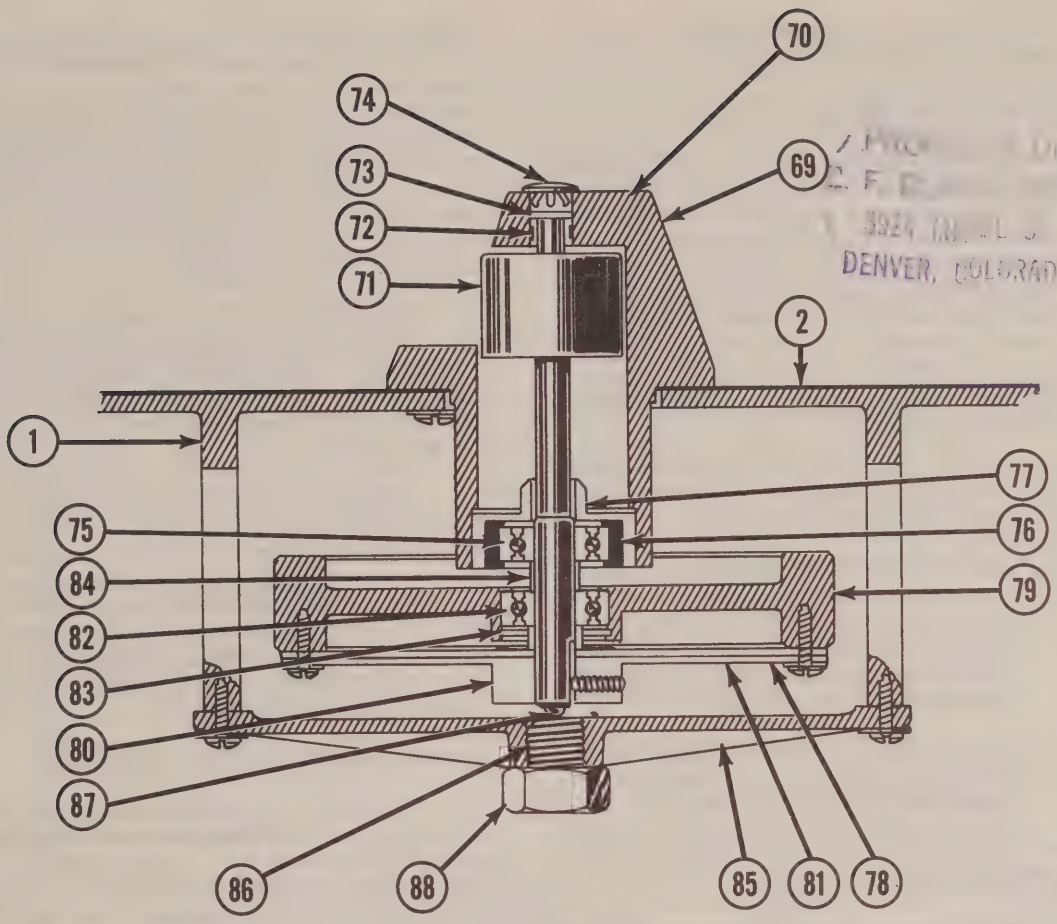

Figure 9

The Brake Arm Pivots are adjusted by a lock nut, so the Brake Arms (36 and 39) will slide freely in their slots. Considerable vertical play can be tolerated at the end of the Brake Arm. Tighten the lock nut down until it bottoms on the Arm. Then back off 1/8 turn or more as required to eliminate any drag or bind in the Brake Arm. An excessively high brake differential can usually be traced to this adjustment.

B. Tape Supply Brake Shoe Clearance.

1. Tape or fasten the Takeup Tension Arm (62) in the operating position. Place the Mechanical Assembly in a position so that the Brake Shoes can be observed and start the recorder.

2. Loosen the two screws that secure the Brake Solenoid (M42) to the Solenoid Mounting Bracket. Slide the Solenoid in the required direction to establish a clearance of 1/64 to 1/32 inch between the Brake Lining and the Brake Drum. Tighten the Solenoid screws securely when the adjustment is correct. As Brake Linings wear the clearance will increase slightly, but this will not affect the performance of the machine.

C. Takeup Brake Shoe Clearance.

The Takeup Brake Clearance is adjusted by the Brake Rod Adjusting Clamp (43) to provide a clearance of 1/64 to 1/32 inch between the Brake Lining and the Brake Drum when the Brakes are released (Brake Solenoid energized). Tighten the set screw (43) securely. The Brake Rod Retaining Ring (100) is placed on the Brake Rod to prevent the Rod being detached from the Brake. Be sure there is at least 5/32 inch clearance between this Ring and the Brake Arm.

D. Brake Pivot Spring Position.

Three holes are located in each Brake Arm to anchor the Brake Pivot Spring (98). Anchoring this spring in the middle hole will normally provide the optimum braking forces previously listed. If this is not the case, move the spring to the hole required to produce the correct braking forces. If the forces should be considerably lower than the optimum values and do not change when the Pivot Spring is moved, contamination of the Brake Drums or Brake Linings is indicated. Clean the Drums as described below.

E. Brake Solenoid Stop (67).

The clearance between the end of the Brake Solenoid plunger and the Stop should be 3/16 inch when the plunger is bottomed. Adjustment is accomplished by bending the Stop Bracket (67) to provide the aforementioned clearance. Be sure that the Stop catches the plunger of the Solenoid but does not drag on

the linkage. Improper adjustment will result in excess braking differential.

F. Brake Drum Cleaning Procedure.

In servicing the recorder the Brake Drums (34 and 35) may become contaminated by handling or by oil or grease getting upon them. Mild cases of contamination will soon disappear through the normal operation of the machine. The Brake Shoe may chatter until the contamination wears off. In such cases cleaning is not necessary if the recorder handles the tape satisfactorily. If operation is unsatisfactory clean both brake drums as follows:

1. Hold a piece of #320 wet-or-dry sandpaper firmly against the braking surface of the Brake Drum.

2. Rotate the Brake Drum four or five revolutions by turning the turntable. It is not necessary to release the brakes for this operation. Shift the sandpaper to a clean spot frequently to avoid contamination of the paper.

3. If this does not cure the condition the Brake Linings have become contaminated and should be replaced. See Section V-V.

3. Constant Tension Brake Adjustment.

The Constant Tension Brake (47) is adjusted for minimum clearance between the Constant Tension Brake Lining (48) and the Tape Supply Brake Drum (34) when the Brake is released. The adjustment is made by the Brake Stop, a set screw and lock nut shown in Figure 8, Point D. As the Brake Lining wears readjustment of the Stop is desirable.

a. Loosen the lock nut. With both the Stopping Brakes and Constant Tension Brakes released, screw in the set screw until a slight drag is noticed on the Brake Drum.
b. Back off the set screw until the drag just disappears.
c. Tighten the lock nut and re-check for drag. The drum should spin freely with both Brakes released. The Constant Tension Arm (44) should have a very short travel - approximately 1/8 inch at the end of the arm.

NOTE: It is important that the force applied to the Constant Tension Brake (47) by the Constant Tension Brake Spring (49) be in the correct direction; otherwise the Brake Lining may wear unevenly and the Brake may oscillate or chatter causing high flutter. This should not be confused with the normal motion of the arm to compensate for discontinuities in the reels. If the Spring is attached to the Takeup Torque Switch (M40) with a solder lug, this lug should be positioned at right angles to the edge of the Switch.

4. Turntable and Brake Drum Height.

The height of both the Turntables (27 or 28) and their respective Brakes Drums (34 and 35) must be carefully adjusted whenever they are removed. Their removal should be avoided unless absolutely necessary. When removing Brake Drums, first loosen the Turntable Set Screws. Loosen the Brake Drum set screws backing them off far enough to prevent galling of the Turntable Shaft. Lift the Turntable from the Brake Drum. Carefully mark the Brake Drums so they will be returned to the same shafts. If it is necessary to replace either a Brake Drum or a Turntable, they must be replaced as a pair.

When replacing Brake Drums, place a little oil on the Turntable Shaft and work the Drum on the shaft. Adjust the Turntable Height so that the top surface of the Turntable Pad (30), is 0.635 inches from the surface of the Mechanical top plate. Be sure to tighten the set screws.

After the correct Turntable Height is set, adjust the Brake Drum height so that the lower spoke side of the Brake Drum lines up with the Turntable Motor Tire. Approximately 1/32 inch of the Drum should show below the tire. Tighten the set screws, being sure that they line up with the flats on the Turntable Shaft. Clean the braking surface of the Brake Drum thoroughly as explained in Section VII-2F as it will become contaminated by handling.

5. Rewind Holdback Brake Adjustment.

The Rewind Holdback Brake (22) is adjusted to give a slight tension during rewind. It should only require adjustment if it is accidentally bent. With the Takeup Brake Drum (35) removed, the lining of the Holdback Brake should assume a position 2 5/8 inches from the edge of the Takeup Turntable Shaft.

6. Reel Idler Adjustment.

Should the Reel Idler (69) be removed, it must be reassembled as shown in Figure 9. Vertical play in the Reel Idler Pulley and Shaft Assembly (71) is provided by the Reel Idler Thrust Bearing (86).

a. Assemble the Reel Idler Housing (70) to the Mechanical Top Plate as shown in Figure 9.
b. Place a spacer 1/16 inch thick between the top of the Reel Idler Pulley (71) and the Reel Idler Housing (70).
c. Make sure that the Reel Idler Ball Bearing is in place. Slide the Reel Idler Spacer (84) on the shaft. Holding the Reel Idler Flywheel (78) by the Square Hub, bottom it against the Spacer and Ball Bearing. Then tighten the set screw.
d. Remove the 1/16 inch spacer between the Reel Idler Pulley and Housing.
e. Insert the Reel Idler Thrust Ball (87), using a little light grease to hold it in place in the center of the Reel Idler Shaft. Attach the Reel Idler Thrust Bracket (85).
f. Screw in the Thrust Bearing (86) until the vertical play in the Reel Idler Shaft and Pulley (71) is between, .010 and .020 inches. Tighten the Lock Nut (88). In the case of rack mounted machines, it is desirable to reduce the play to .003 to .005 inches.
g. Re-check to see that the play still exists after the Lock Nut is tightened. Insufficient clearance will prevent the proper operation of the idler. It should spin without drag.

7. Takeup Torque Switch Adjustment.

The Takeup Torque Switch (M40) plays an important role in starting the recorder in the Play mode. It allows full voltage to be applied to the Turntable Motor until the Capstan Idler engages the tape, facilitating fast starting without throwing tape slack. The adjustment is made by bending the tongue of the micro switch. To check for correct adjustment, actuate the armature of the Capstan Solenoid (M41) by hand. The Takeup Torque Switch should "click" or open after the Capstan Idler (50) has made firm contact with the Capstan (A) but slightly before the armature of the Solenoid seats. Allow approximately 1/32 inch over travel for safety. Check the Play Takeup Torque as explained in Part 9 of this Section. If the torque is considerably more than 7 ounces, the Takeup Torque Switch is not opening. Severe deformation of tape may result and the Turntable Motor may overheat to the point of destruction.

8. Forward and Rewind Tilt Solenoid Adjustment.

The Forward Tilt Solenoid (M44) and the Rewind Tilt Solenoid (M43) position the Turntable Motor (6) to engage the proper Brake Drum depending upon the mode of operation. Adjustment is made by lock nuts. They should be adjusted sufficiently tight to prevent any slippage between the Turntable Motor Tire and the Brake Drums.

The adjustment consists of the following:

a. Remove the Turntable Motor Positioning Spring (68).
b. Back off the Solenoid Adjusting Nuts until the Turntable Tire will not touch the Brake Drums when either Solenoid is bottomed.
c. Tighten either Solenoid Adjusting Nut until the Tire just touches the Drum with the Solenoid bottomed. Then tighten the nut one full turn after this contact. In order to bottom Solenoid and indicate tire contact with the Drum, fasten the Takeup Tension Arm (62) in the operating position and start the recorder in the Rewind or Fast Forward mode as required.
d. Repeat Setp C with the other Solenoid.

9. Play Takeup Torque Adjustment.

The voltage to the Turntable Motor (6) is reduced through the Play Resistor (R56) in the Play mode of operation. Moving the slide on this resistor toward the Mechanical Top Plate increases the voltage to the Turntable Motor and its torque. To check for proper torque:

a. Fasten the Takeup Tension Arm (62) in operating position.
b. Attach a piece of string about 30 inches long to hub of the 10 1/2 inch Takeup Reel with the other end attached to a spring scale (0 to 16 oz. preferred).
c. Place the recorder in Play mode.
d. The Takeup tension should be 7 to 71/2 ounces as the scale is allowed to move slowly in the direction of pull.

10. Safety Switch Adjustment.

The Safety Switch (M24) is factory adjusted and should not require attention unless the switch or Takeup Tension Arm (62) is removed. The Safety Switch is actuated by the pin that holds the Takeup Tension Collar (63) to the Takeup Tension Arm (62). The tongue of the Safety Switch should be bent so the micro switch opens slightly before the end of travel of the Takeup Tension Arm. Allow 1/4 inch over-travel of the arm for dependability.

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SECTION VIII

ELECTRONIC ALIGNMENT

Alignment is the necessary adjustments required to have the Electronic Assembly of the recorder perform properly. A machine "out of alignment" may be characterized by poor frequency response, high noise, low output, or high distortion. No adjustments should be necessary except as required by routine maintenance where the machine will not perform as indicated under Specification Section I when checked according to Section II-VIII.

Alignment consists of the following steps:

I. Head Alignment.

II. Erase Adjustment.

III. Record Level Meter Calibration.

A standard tape is available for alignment purposes and contains the following frequency run recorded at 15 inches per second, 10db below 15 inch operating level.

CAUTION: Before playing the standard tape demagnetize the heads with the Ampex Head Demagnetizer, catalog #704. Magnetized heads will cause a partial erasure of the high frequencies on the standard tape.

1 KC for level adjustment.
15 KC for playback azimuth alignment.

50 cycles	8000 cycles
100 cycles	9000 cycles
200 cycles	10,000 cycles
400 cycles	11,000 cycles
800 cycles	12,000 cycles
1600 cycles	14,000 cycles
3200 cycles	15,000 cycles
6400 cycles	

I. Head Alignment:

The high frequency response of the recorder depends on the correct head alignment. If tapes are to be interchangeable from one machine to another the heads of all machines must have the same azimuth setting. This is accomplished by using a standard tape (Catalog #1993) for aligning the heads of all machines. Head alignment is independent of tape speed; however it is recommended that the heads be aligned at 15 inches per second since the standard tape is recorded at this speed.

Remove the top cover from the head housing by removing the two screws from the top and pulling cover gently back and up. Looking at the head housing from the front the three heads from left to right are: Erase, Record and Playback.

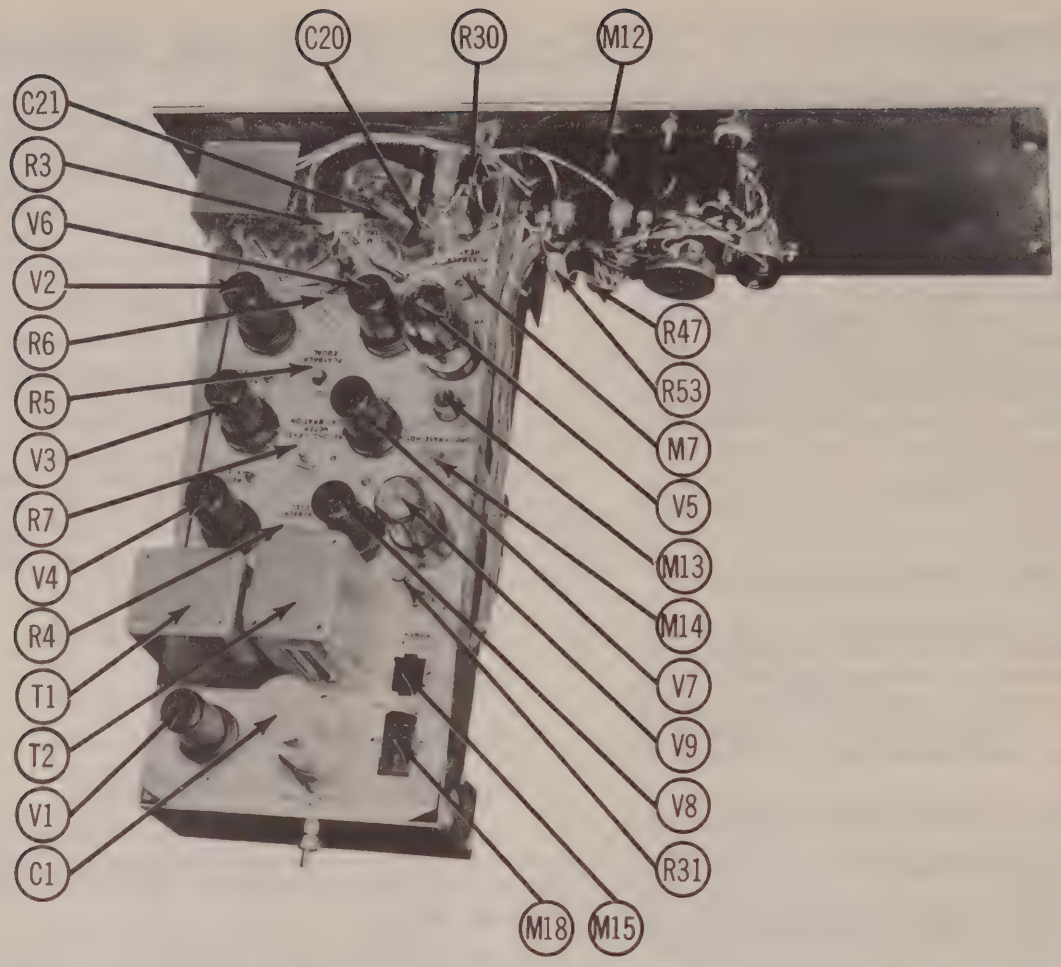

Figure 10

The azimuth angle of the erase head is not adjustable.

The record and playback heads should be aligned only after reading and fully understanding the procedure under Playback and Record Circuit Alignment.

The actual physical alignment of the Record and Playback Heads consists of placing a 1/4" spintite socket wrench on the left hand elastic stop nut in each head and adjusting back and forth until the proper azimuth angle is arrived at.

First adjust the Playback Head azimuth by playing the standard tape at 15 inches per second and adjusting the stop nut for the maximum output of the 15 KC tone (second tone that appears on the standard tape).

The Record Head azimuth is then aligned with the Playback Head by recording a 15,000 cycle signal from an audio oscillator on a blank tape and adjusting the record stop nut for maximum playback output.

II. Erase Adjustment.

The erase current is factory adjusted and no further adjustment should be necessary unless the erase head is replaced; Should this happen the following procedure must be followed:

a. Set the meter and output switch (M8) in the erase position and press the record button (M5).
b. Back off the erase trimmer (C33) to minimum capacity (clockwise direction).
c. Increase the capacity until the meter reads 0 (zero).

III. Record Level Meter Calibration:

The record level meter calibration control (R7) is adjusted so that the program level as read on the VU Meter is the same as monitored from the playback head or the incoming line. This is accomplished by recording a 400 cycle tone (or program in the absence of an audio oscillator) at 0 (zero) on the VU Meter with the meter and output switch (M8) in the Playback-Level position. Then switch the Meter and Output Switch to the Record - Level position and adjust the record level meter calibration control (R7) for 0 (zero) on the VU Meter.

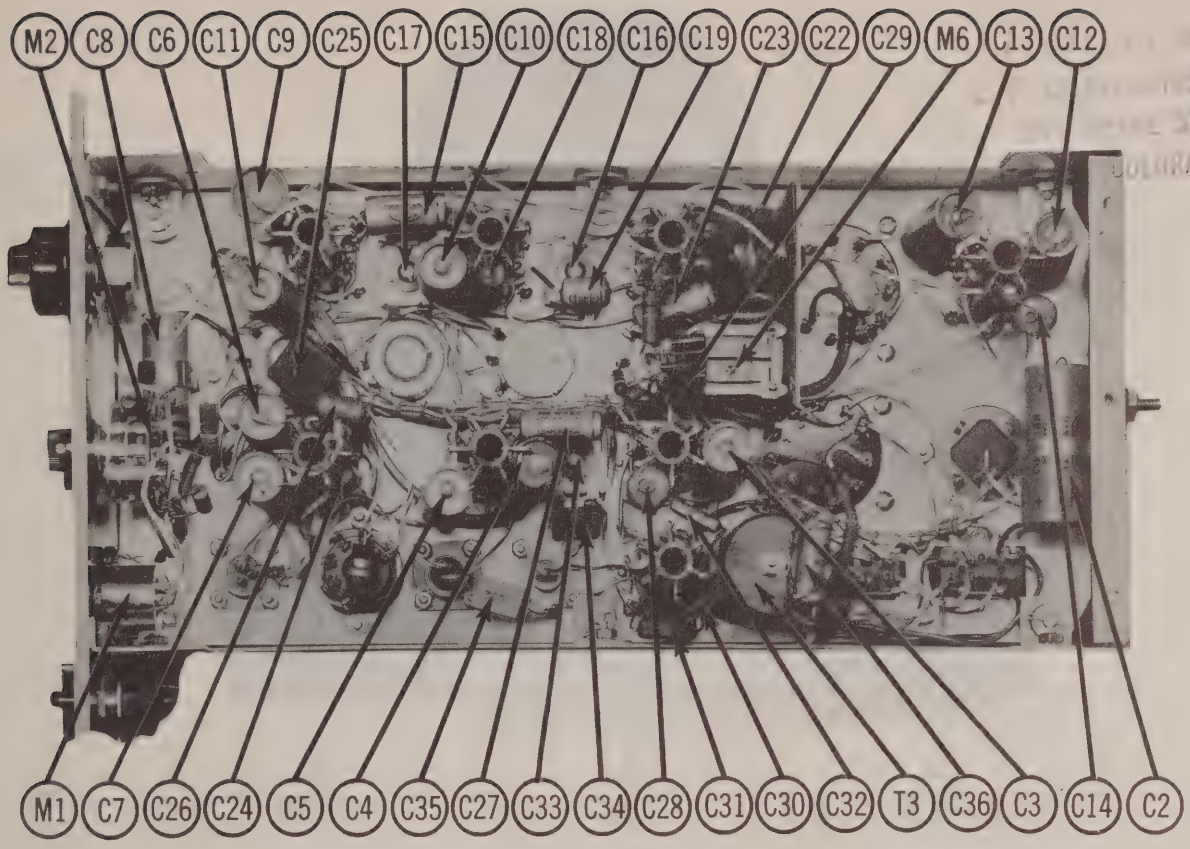

Figure 11

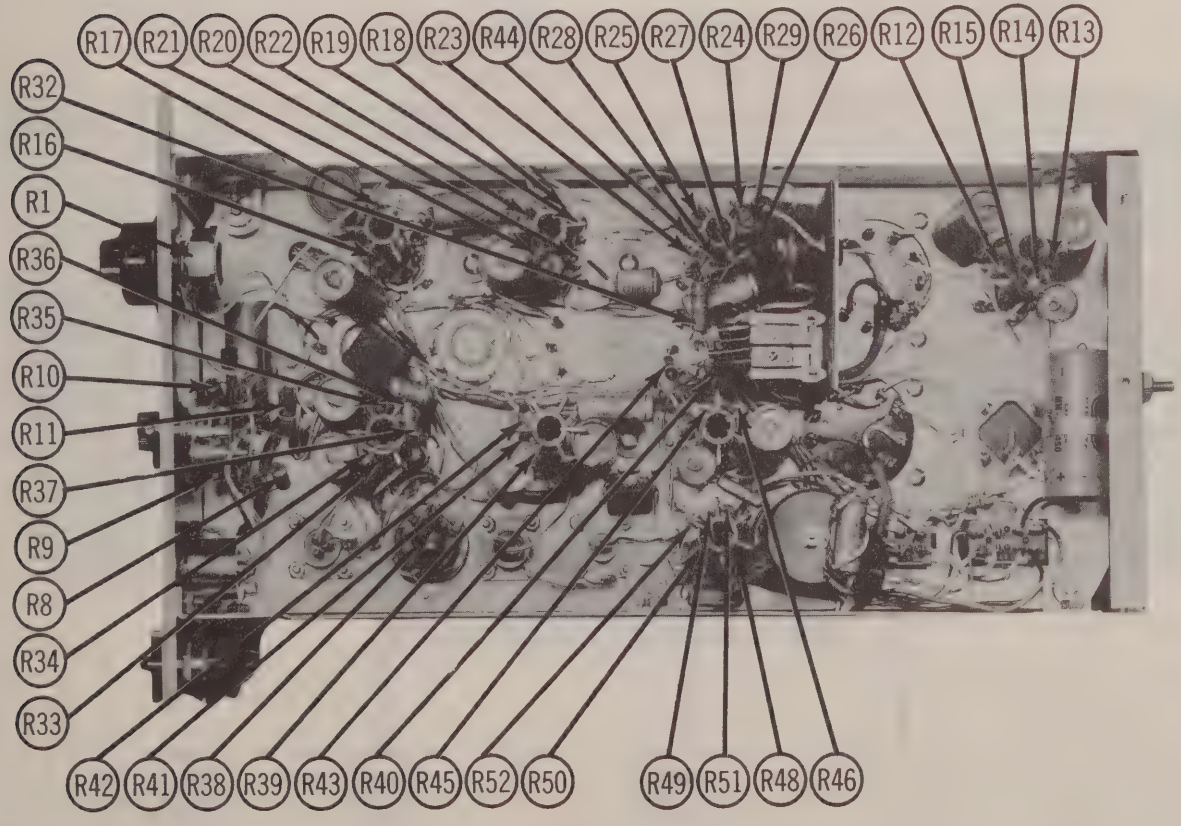

Figure 12

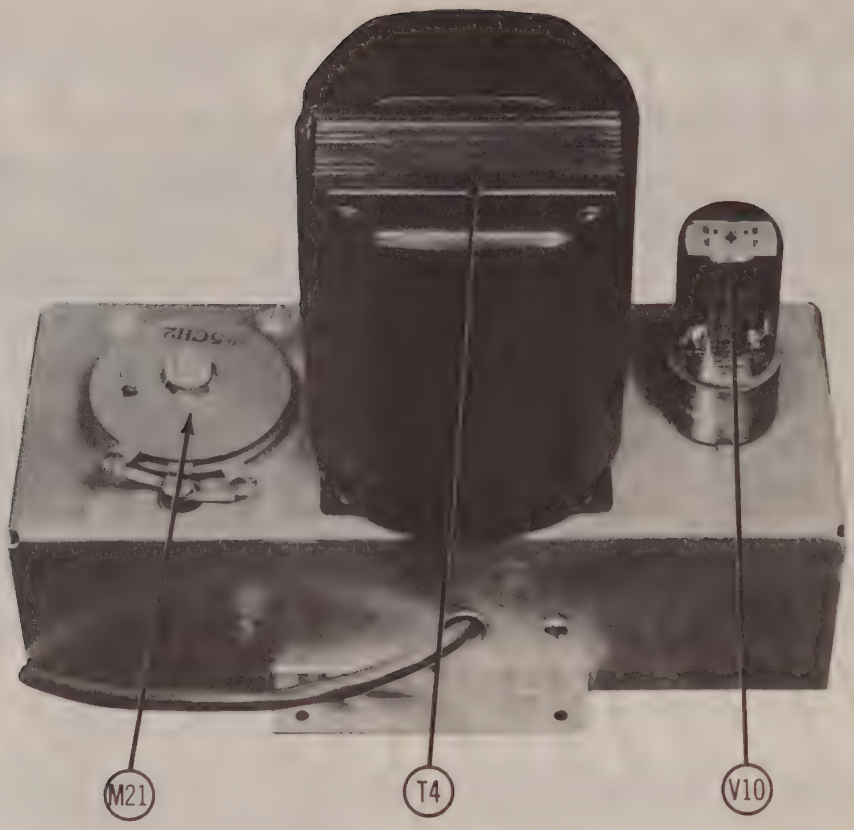

Figure 13

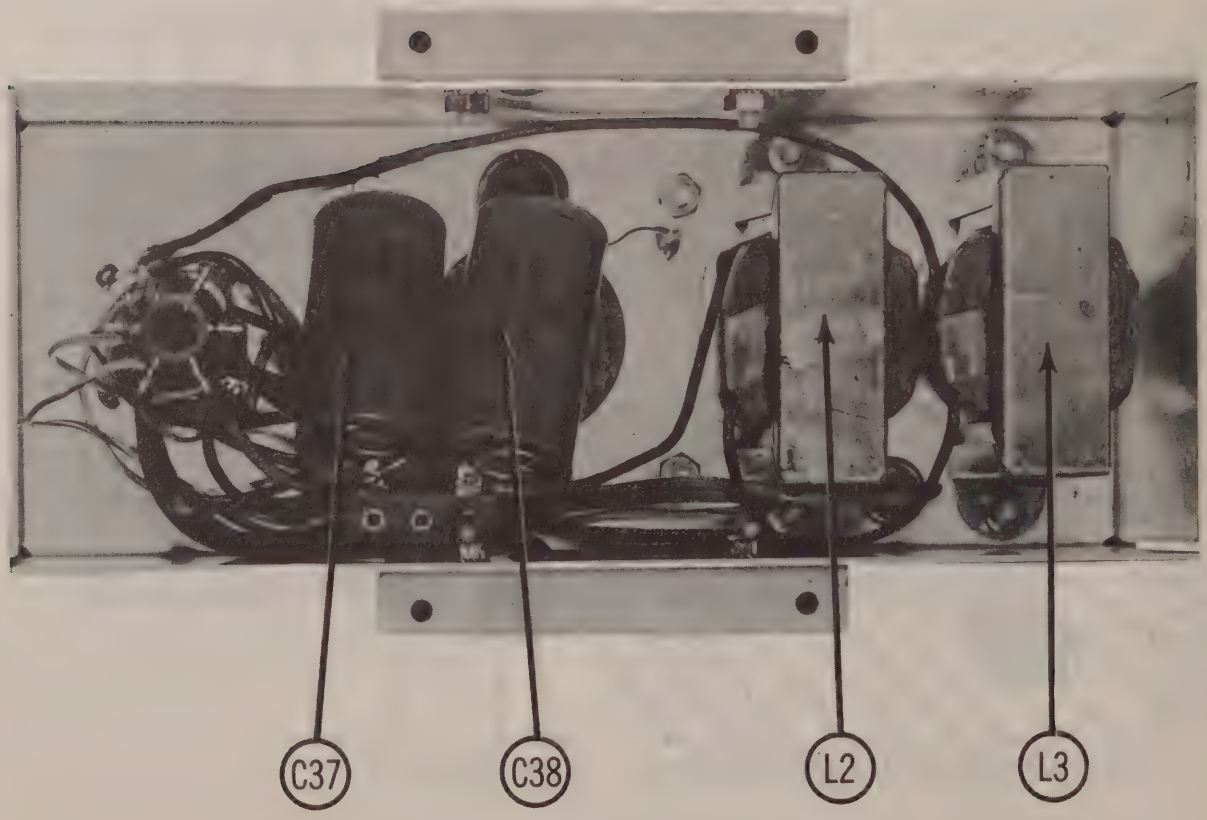

Figure 14

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AMPEX
PARTS LIST

ELECTRONIC ASSEMBLY MODEL 400A

Ref. No.	Part No.	Description
V1	TU-11	12SJ7, Mic. Pre-Amp.
V2	TU-11	12SJ7, AF Amp. (Record)
V3	TU-11	12SJ7, AF Amp. (Record)
V4	TU-3	6J5, Record Output
V5	TU-2	VR150/0D3, Voltage Regulator
V6	TU-12	12SJ7, Playback Pre-Amp. (Selected)
V7	TU-11	12SJ7, AF Amp. (Playback & Monitor)
V8	TU-3	6J5, AF Output
V9	TU-13	6SN7, Bias Osc.
C1	C0-66	Elect. Capacitor, 2000 Mfd. @ 15V.
C2	C0-57	Elect. Capacitor, 20 Mfd. @ 450V.
C3	C0-59	Elect. Capacitor, 25 Mfd. @ 25V.
C4	C0-54	Elect. Capacitor, 4 Mfd. @ 450V.
C5	C0-59	Elect. Capacitor, 25 Mfd. @ 25V.
C6	C0-53	Elect. Capacitor, 4 Mfd. @150V.
C7	C0-59	Elect. Capacitor, 25 Mfd. @25V.
C8	C0-56	Elect. Capacitor, 16 Mfd. @150V.
C9	C0-55	Elect. Capacitor, 10 Mfd. @450V.
C10	C0-59	Elect. Capacitor, 25 Mfd. @25V.
C11	C0-59	Elect. Capacitor, 25 Mfd. @25V.
C12	C0-53	Elect. Capacitor, 4 Mfd. @150V.
C13	C0-59	Elect. Capacitor, 25 Mfd. @25V.
C14	C0-45	Metalized Paper Cap.,. 25 Mfd. @400V.
C15	C0-45	Metalized Paper Cap.,. 25 Mfd. @400V.
C16	C0-92	Padder Cap., .0001 Mfd.
C17	C0-92	Padder Cap., .0001 Mfd.
C18	C0-101	Metalized Paper Cap.,. 1 Mfd. @400V.
C19	C0-43	Metalized Paper Cap.,. 05 Mfd. @400V.
C20	C0-12	Mica Cap. 5%, .005 Mfd. @500V.
C21	C0-8	Mica Cap. 5%, .0025 Mfd. @500V.
C22	C0-47	Metalized Paper Cap., 1 Mfd. @400V.
C23	C0-44	Metalized Paper Cap.,. 1 Mfd. @400V.
C24	C0-97	Metalized Paper Cap.,. 1 Mfd. @200V.
C25	C0-14	Mica Cap. 5%, .01 Mfd. @300V.
C26	C0-42	Metalized Paper Cap.,. 01 Mfd. @400V.
C27	C0-44	Metalized Paper Cap.,. 1 Mfd. @400V.
C28	C0-46	Metalized Paper Cap., .5 Mfd. @400V.
C29	C0-44	Metalized Paper Cap., .1 Mfd. @400V.
C30	C0-89	Mica Cap. 5%, .0004 Mfd. @500V.
C31	C0-7	Mica Cap. 5%, .002 Mfd. @500V.
C32	C0-89	Mica Cap. 5%, .0004 Mfd. @500V.
C33	C0-91	Padder Cap., .001 Mfd.
C34	C0-5	Mica Cap. 5%, .0005 Mfd. @500V.
C35	C0-90	Mica Cap., .0002 Mfd. @500V.
C36	C0-44	Metalized Paper Cap., .1 Mfd. @400V.
R1	RE-227	Record Level, 100KΩ Control
R2	RE-278	Bias Control, 40KΩ Control, W.W.
R3	RE-277	Bias Calibration, 500Ω, 10Watt W.W. - Adjustable
R4	RE-232	Playback Level, 1 Meg. Control
R5	RE-240	Playback Equalizer, 20Ω Control
R6	RE-226	Noise Balance, 50 KΩ Control
R7	RE-227	Record Level Meter Calibration, 100 KΩ Control
R8	RE-27	220 KΩ, 1 Watt Resistor
R9	RE-38	100Ω, 1 Watt Resistor 5%
R10	RE-38	100Ω, 1 Watt Resistor 5%
R11	RE-27	220KΩ, 1 Watt Resistor
R12	RE-261	1200Ω, 1 Watt Resistor
R13	RE-30	330KΩ, 1 Watt Resistor
R14	RE-205	100KΩ, 1 Watt Resistor 1%
R15	RE-32	1 Meg., 1 Watt Resistor
R16	RE-7	2200Ω, 1 Watt Resistor
R17	RE-22	47KΩ, 1 Watt Resistor
R18	RE-48	1 Meg., 1 Watt Resistor 5%
R19	RE-44	39KΩ, 1 Watt Resistor 5%
R20	RE-26	100KΩ, 1 Watt Resistor
R21	RE-7	2200Ω, 1 Watt Resistor
R22	RE-22	47KΩ, 1 Watt Resistor
R23	RE-31	470KΩ, 1 Watt Resistor
R24	RE-2	470 Ω, 1 Watt Resistor
R25	RE-7	2200Ω, 1 Watt Resistor
R26	RE-171	22KΩ, 2 Watt Resistor
R27	RE-32	1 Meg., 1 Watt Resistor
R28	RE-31	470KΩ, 1 Watt Resistor
R29	RE-22	47KΩ, 1 Watt Resistor
R30	RE-26	100KΩ, 1 Watt Resistor
R31	RE-92	15KΩ, 10 Watt Resistor
R32	RE-260	100Ω, 1 Watt Resistor
R33	RE-211	1 Meg., 1 Watt Resistor 1%
R34	RE-7	2200Ω, 1 Watt Resistor
R35	RE-211	1 Meg., 1 Watt Resistor 1%
R36	RE-209	330KΩ, 1 Watt Resistor 1%
R37	RE-32	1 Meg., 1 Watt Resistor
R38	RE-171	22KΩ, 2 Watt Resistor
R39	RE-8	2700Ω, 1 Watt Resistor
R40	RE-3	560Ω, 1 Watt Resistor
R41	RE-32	1 Meg., 1 Watt Resistor
R42	RE-30	330KΩ, 1 Watt Resistor
R43	RE-22	47KΩ, 1 Watt Resistor
R44	RE-168	10KΩ, 2 Watt Resistor
R45	RE-32	1 Meg., 1 Watt Resistor
R46	RE-7	2200Ω, 1 Watt Resistor
R47	RE-3	560Ω, 1 Watt Resistor
R48	RE-260	100Ω, 1 Watt Resistor
R49	RE-22	47KΩ, 1 Watt Resistor
R50	RE-22	47KΩ, 1 Watt Resistor
R51	RE-260	100Ω, 1 Watt Resistor
R52	RE-257	7Ω, 1 W. Resistor 1% (2-14Ω in Parallel)
R53	RE-258	3600Ω, 1 Watt Resistor
T1	1153	Mic. Input Transformer
T2	1154	Output Transformer
T3	1011	Erase Transformer
L1	CH-8	R.F. Choke, 20Mh
M1	PL-58S	Cannon XL-3-13 Chassis Connector
M2	SW-7	Input Switch-3P3T Selector Switch
M3	SW-8	Equalization Switch-3P2T Sel. Switch
M4	DL-4	Record Pilot Lamp
M5	SW-34	Record Pushbutton SPST-Normally Open
M6	RL-8	Record Relay 3PDT 115V. DC
M7	PL-59P	AN-3102-10S-3P Box Mount Connector
M8	SW-13	Meter & Output Sw. -3P4T Sel. Switch
M9	PL-4P	Cannon XL-3-14 Chassis Connector
M10	JA-3	Phone Jack - Open Circuit
M11	SW-9	Line Termination Sw. -SPST Toggle
M12		VU Meter
M13	PL-61P	AN-3102-10S-4P Box Mount Connector
M14	PL-62P	AN-3102-10S-2P Box Mount Connector
M15	PL-56S	Jones S-304-AB Chassis Connector
M16	FU-2	Fuse, 2 Amp., Type 3AG
M17	FU-7	Fuse, 1 Amp., "Slo-Blo" Type 3AG
M18	PL-54S	Jones S-308-AB Chassis Connector
M19	SW-9	AC Power Switch-SPST Toggle
M20	PL-104P	Hubbell #7466 Chassis Connector

POWER SUPPLY MODEL 400A

Ref. No.	Part No.	Description
V10	TU-14	5Y3-GT, Rectifier
C37	C0-57	Elect. Capacitor, 20 Mfd. @ 450V.
C38	C0-57	Elect. Capacitor, 20 Mfd. @ 450V.
T4	3953	Power Transformer
L2	1155	8 Hy. 80 Ma. Filter Choke
L3	1155	8 Hy. 80 Ma. Filter Choke
M21	SR-3	Selenium Rectifier
M22	PL-103P	Jones P-308-CCT-L Cable Connector

CONTROL CIRCUIT MODELS 400A, 402, 403

Ref. No.	Part No.	Description
C39	C0-105	Elect. Capacitor, 80 Mfd. @ 150V.
C40	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C41	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C42	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C43	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C44	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C45		Motor Start Capacitor Supplied With Motor - See Note 1.
C46	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C47		Motor Start Capacitor Supplied With Motor - See Note 1.
C48	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C49	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C50	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.
C51	C0-33	Tubular Capacitor, .1 Mfd. @ 600V.

CONTROL CIRCUIT MODELS 400A, 402, 403 (Cont'd.)

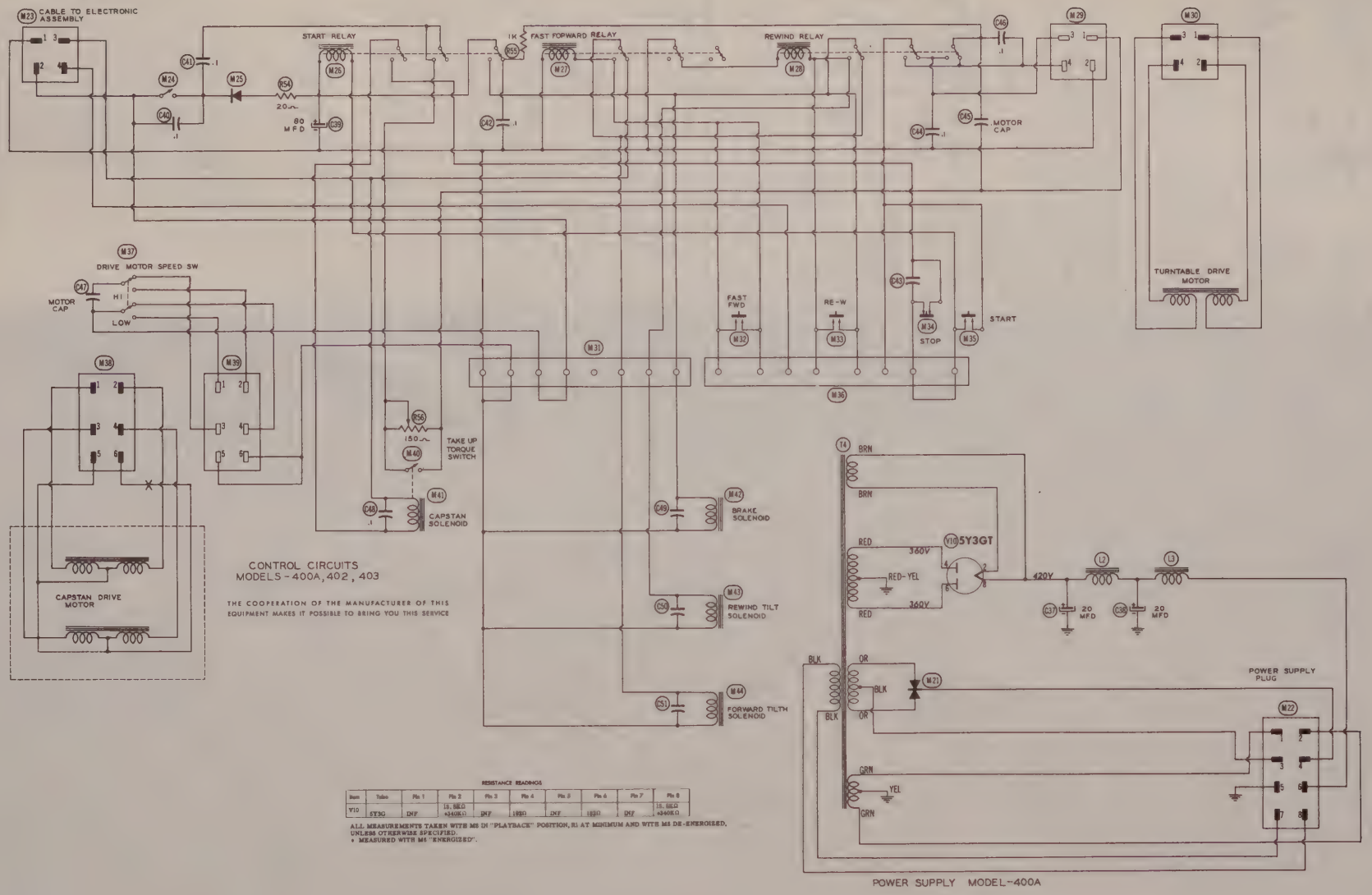
Ref. No.	Part No.	Description
R54	RE-309	20Ω, 10 Watt Resistor W.W.
R55	RE-113	1000Ω, 25 Watt Resistor W.W.
R56	RE-259	150Ω, 50 Watt Adjustable Resistor
M23	PL-99P	Jones P-304-CCT-L Cable Connector
M24	3604	Safety Switch - Micro Switch
M25	SR-4	Selenium Rectifier
M26	RL-26	Start Relay 3PDT, 115V. DC
M27	RL-26	Fast Forward Relay 3PDT, 115V. DC
M28	RL-26	Rewind Relay 3PDT, 115V. DC
M29	PL-100S	Jones S-304-CCT-K Cable Connector
M30		
M31	TS-2-8	60 Cycle Amp. Terminal Strip, Jones 8-170
M32	SW-34	Fast Forward Pushbutton-SPST Normally Open
M33	SW-34	Rewind Pushbutton-SPST Normally Open
M34	SW-35	Stop Pushbutton-SPST Normally Closed
M35	SW-34	Start Pushbutton-SPST Normally Open
M36	TS-2-8	Remote Control Terminal Strip, Jones 8-170
M37	SW-5	Speed Switch-DPDT Toggle
M38	PL-101P	Jones P-306-CCT-L Cable Connector
M39	PL-102S	Jones S-306-CCT-K Cable Connector
M40	SW-2	Takeup Torque Switch-Micro Switch
M41	670	Capstan Solenoid, DC
M42	337	Brake Solenoid, DC
M43	337	Rewind Tilt Solenoid, DC
M44	337	Forward Tilt Solenoid, DC

NOTE 1

When ordering Motor Start Capacitors, include the serial number of the Recorder, whether the motor is the Turntable Motor or Drive Motor, the manufacturer of the motor, and the manufacturer's type number found on the motor name plate.

MECHANICAL PARTS LIST

Ref. No.	Part No.	Description
1	2694	Top Plate Casting
2	2110	Top Plate Facing Plate
3	2093	Bushing, Takeup Tension Arm
4	2094	Bushing, Capstan Idler Arm
5	2092	Bushing, Constant Tension Arm
6	2102	Turntable Motor Assembly, complete with Motor, Bracket, Pulley and Capacitor.
7	934	Rubber Tired Pulley
8	932	Bracket
9	2680	Spacers
10	2101	Solenoid Mounting Bracket
11	3311	Relay Mounting Bracket
12	2107	Turntable Motor Mounting Bracket
13	335	Solenoid Link
14	2081	Solenoid Spade Bolt
15	CP-1/16-2	Solenoid Cotter Pin
16	CQ-1/8-15	Solenoid Clevis Pin
17	2349	Terminal Strip Standoff
18	930	Turntable Motor Pivot - Front
19	3370	Turntable Motor Arm and Pivot Assembly
20	928	Felt Washer
21	2237	Tilt Solenoid Return Spring
22	3359	Rewind Holdback Brake
23	3853	Brake Lining
24	2216	Capstan Drive Motor Assembly-60 Cycle, complete with Flywheel and Capacitor
	3380	Capstan Drive Motor Assembly-50 Cycle, complete with Flywheel and Capacitor
25	FA-1	Drive Motor Fan
26	3506	Capstan Dust Cap
27	2229	Tape Supply Turntable Assembly
28	2229	Takeup Turntable Assembly
29	974	Turntable and Shaft Sub-Assembly
30	958	Turntable Pad
31	BC-7	Ball Bearing
32	2226	Bearing Housing
33	RR-1-3	Retaining Ring
34	977	Tape Supply Brake Drum
35	977	Takeup Brake Drum
36	2098	Tape Supply Stopping Brake
37	3853	Brake Lining
38	3851	Tape Supply Brake Spring
39	2105	Takeup Stopping Brake
40	3853	Brake Lining
41	3850	Takeup Brake Spring
42	2091	Brake Rod
43	967	Brake Adjusting Clamp
44	2099	Constant Tension Arm Assembly
45	3357	Tape Guide
46	355	Tape Guide Hook
47	2104	Constant Tension Brake
48	3853	Brake Lining
49	1024	Constant Tension Brake Spring
50	995	Capstan Idler Assembly
51	2197	Capstan Idler Arm
52	2084	Capstan Solenoid Arm
53	388	Capstan Solenoid Stop
54	396-2	Capstan Solenoid Eye Bolt
55	PW-6-1/4-416-816	Solenoid Felt Washer
56	2372	Solenoid Terminal Strip
57	CP-1/16-2	Solenoid Cotter Pin
58	CQ-1/8-17	Solenoid Clevis Pin
59	389	Capstan Idler Pressure Spring
60	3808	Capstan Idler Return Spring
61	2075	Takeup Torque Switch Engaging Washer
62	2103	Takeup Tension Arm
63	2085	Takeup Tension Collar
64	3809	Takeup Tension Return Spring
65	3689	Counterbalance Spring
66	3683	Counterbalance Spring Anchor
67	3807	Brake Solenoid Stop Bracket
68	3850	Turntable Motor Positioning Spring
69	2213	Reel Idler Assembly
70	2207	Reel Idler Housing
71	2215	Reel Idler Pulley and Shaft Assembly
72	2209	Upper Bearing
73	2248	Felt Washer
74	PB-1-516	Plug Button
75	BC-7	Ball Bearing
76	BD-1	Rubber Bearing Housing
77	2210	Bearing Adapter
78	2223	Reel Idler Flywheel Assembly
79	2221	Flywheel
80	2220	Hub and Dampener Assembly
81	2219	Limit Stop
82	BC-7	Ball Bearing
83	RR-2-4	Retaining Ring
84	352	Reel Idler Spacer
85	2222	Reel Idler Thrust Bracket
86	2208	Reel Idler Thrust Bearing
87	BC-18	Reel Idler Thrust Ball
88	NU-16-816	Reel Idler Jam Nut-1/2-20
89	257	Capstan Tape Guide
90	1402	Capstan Tape Guide Spacer
91	923	Capstan Tape Guide Shimming Washers
92	1098	Motor Capacitor Clamp
93	2691	Pushbutton Excutcheon Plate
94	2371	Selenium Rectifier Terminal Board
95	2373	Selenium Rectifier Insulating Strip
96	910	Brake Pivot Washer
97	3439	Terminal Strip Insulation
98	3582	Brake Pivot Spring
99	3603	Brake Spring Link
100	RR-4X-2	Brake Rod Retaining Ring
101	PW-1-1016	Motor Pivot Washer



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V10	5Y3G	INF	15. OHMS +400K Ω	INF	1850	INF	1820	INF	15. OHMS +400K Ω

ALL MEASUREMENTS TAKEN WITH M8 IN "PLAYBACK" POSITION, R1 AT MINIMUM AND WITH M8 DE-ENERGIZED, UNLESS OTHERWISE SPECIFIED.
• MEASURED WITH M8 "ENERGIZED".

A PHOTOFACT STANDARD NOTATION SCHEMATIC

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Figure 15

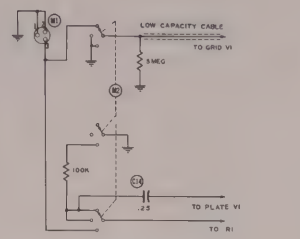


Figure 16A
INPUT FOR HIGH IMPEDANCE MICROPHONE
(SEE INSTALLATION)

T1 TRANSFORMER IMPEDANCE CONNECTIONS—

B44 MUST BE ADJUSTED FOR OUTPUT IMPEDANCE—

500 to 600 OHMS CONNECT TO 1 & 9	JOIN 3 TO 4
333 OHMS CONNECT TO 1 & 3	JOIN 3 TO 4
200 to 250 OHMS CONNECT TO 3 & 1	JOIN 3 TO 4
125 to 150 OHMS CONNECT TO 1 & 9	JOIN 1 TO 3 & 5 TO 6
50 OHMS CONNECT TO 3 & 4	JOIN 2 TO 3 & 4 TO 5

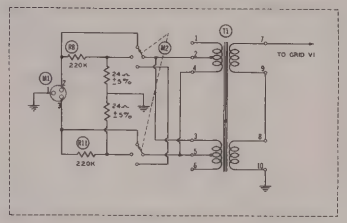
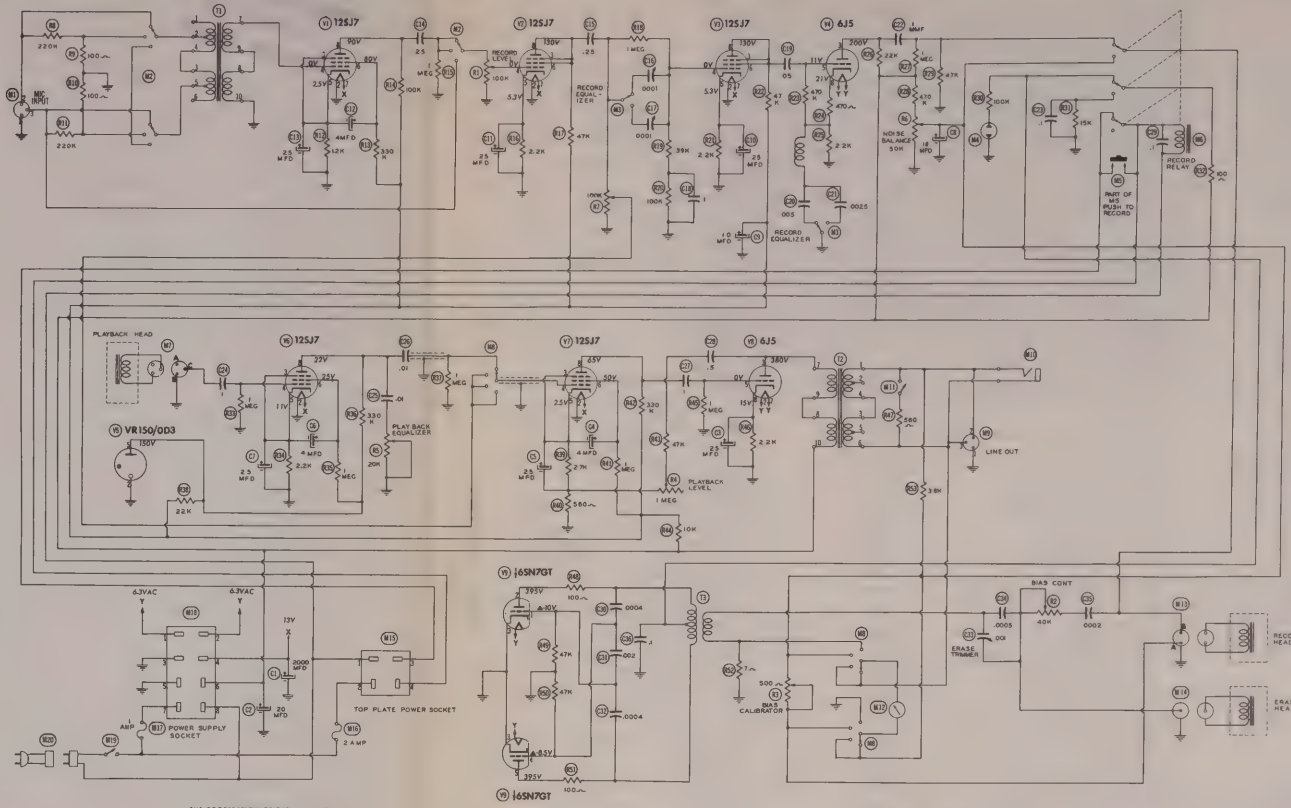


Figure 16B
INPUT TRANSFORMER CONNECTION FOR
50 & 30 OHMS MICROPHONES
(SEE INSTALLATION)



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ELECTRONICS MODEL-400A

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RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
V 1	12SJ7	0Ω	0Ω	1.2KΩ	3.1KΩ	1.2KΩ	†340KΩ	2.5Ω	†10KΩ
V 2	12SJ7	0Ω	0Ω	†57KΩ	12Ω	2.2KΩ	†57KΩ	2.5Ω	†57KΩ
V 3	12SJ7	0Ω	0Ω	†57KΩ	125KΩ	2.2KΩ	†57KΩ	2.5Ω	†57KΩ
V 4	6J5	0Ω	.2Ω	†22KΩ	50KΩ	470KΩ	†10.1KΩ	.2Ω	2.7KΩ
V 5	0D3/VR150	†10KΩ	0Ω	INF	INF	†32KΩ	INF	INF	INF
V 6	12SJ7	0Ω	0Ω	2.2KΩ	1 Meg	2.2KΩ	†1Meg	2.5Ω	†360KΩ
V 7	12SJ7	0Ω	0Ω	3.3KΩ	1 Meg ■3KΩ	3.3KΩ	†1Meg	2.5Ω	†340KΩ
V 8	6J5	0Ω	.3Ω	†1.3KΩ	INF	1 Meg	INF	.2Ω	2.2KΩ
V 9	6SN7GT	47KΩ	†700Ω	0Ω	47KΩ	†700Ω	0Ω	.2Ω	.2Ω

ALL MEASUREMENTS TAKEN WITH M8 IN "PLAYBACK" POSITION, R1 AT MINIMUM AND WITH M6 DE-ENERGIZED, UNLESS OTHERWISE SPECIFIED.
■ MEASURED WITH M8 IN "RECORD" POSITION .
* DO NOT MEASURE
† MEASURED FROM PIN 2 OF V10.
♦ MEASURED WITH M6 " ENERGIZED".

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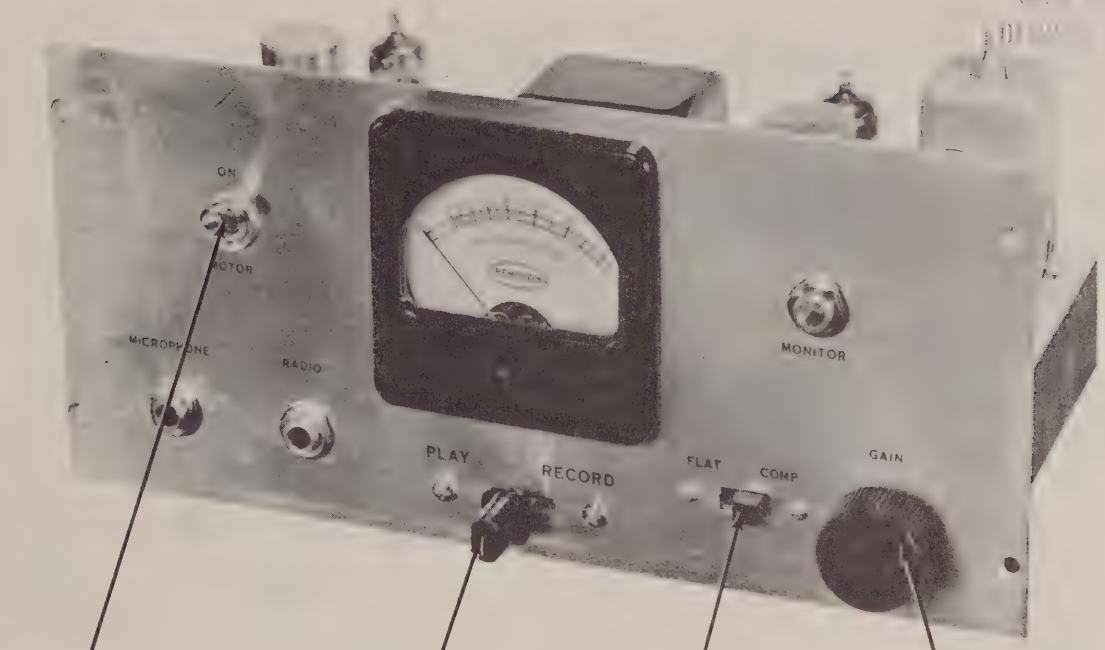
E ST.

PENTRON
MODEL HFP-1



MOTOR ON-OFF SWITCH

PLAY RECORD SWITCH

FLAT COMP. SWITCH

GAIN CONTROL ON-OFF SWITCH

PENTRON
MODEL HFP-1

TRADE NAME	Pentron Model HFP-1
MANUFACTURER	The Pentron Corp., 221 E. Cullerton Ave., Chicago, Ill.
TYPE SET	AC Operated 3 Channel Audio Pre-Amplifier for Tape Recorders and/or power amplifiers
TUBES (Five)	Types 6AU6 Pre-Amp., 6AU6 AF Amp., 12AT7 AF Amp., 12AU7 Bias Osc., 6X4 Rectifier
POWER SUPPLY	110-120 Volts - 60 Cycles RATING .22 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

PENTRON
MODEL HFP-1

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		PENTRON PART No.	STANDARD REPLACEMENT		
V1	Pre-Amplifier	6AU6	6AU6	7BK	
V2	1st. AF Amplifier	6AU6	6AU6	7BK	
V3	2nd. AF Amplifier	12AT7	12AT7	9A	
V4	Bias Osc.	12AU7	12AU7	9A	
V5	Rectifier	6X4	6X4	5BS	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

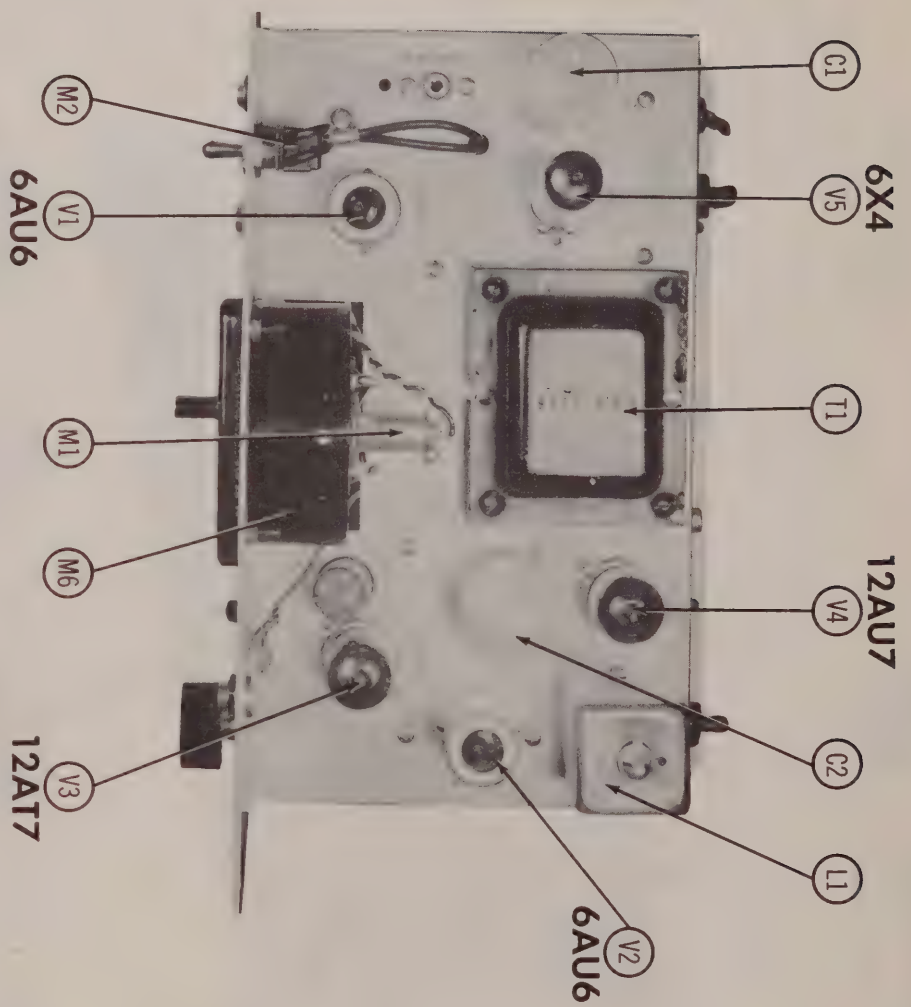
ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	PENTRON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C1A	▲15	350		AFH2-36		B029		FP225	TVL-2660	
B	■15	350								
C2A	■15	350		AFH2-36		B029		FP225	TVL-2660	
B	▲15	350								
C3	.1	400		P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C4	10000			BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C5	10000			BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C6	1000			BPD-001	DD-102	K069	801-102	DC-521	5HK-D1	
C7	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C8	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C9	.01	600		P688-01	D6-103	CUB6S1	GP2-333-103	PT611	6TM-S1	
C10	1000			BPD-001	DD-102	K069	801-102	D6-521	5HK-D1	
C11	.25	200		P288-25		PJ2P25		PT4025	2TM-P25	
C12	.003	600		P688-003	D6-302	CUB6D2	GP2-333-302	PT623	6TM-D3	
C13	10000			BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	Note 1
C14	.1	400		P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C15	500	500		1468-0005		5W5T5		MCB245	MS-35	
C16	200	500		1468-0002		5W5T2		MCB237	MS-32	
C17	.02	400		P488-02	DF-203	CUB4S2		PT412	4TM-S2	
C18	500	500		1468-0005		5W5T5		MCB245	MS-35	
C19	500	500		1468-0005		5W5T5		MCB245	MS-35	
C20	2500	500		1467-0025		1W5D25		MCB460	1FM-23	
C21	.05	400		489ZX-05	DF-503	PJ4S5		PT415	4TM-S5	

Note 1. Not used in all models.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	PENTRON PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	250KΩ	½	6163943	Q13-130	A47-250K-Z	BSK-51-S	U-44	Gain
B	Shaft		Not Req.	Not Req.	KSS-3	Not Req.	Not Req.	Attach to R1A
C	Switch		Not Req.	76-1	SWE-12	Not Req.	US-26	Attach to R1A

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA PENTRON PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R2	1Meg	1/2		BTS-1Meg	
R3	2200Ω	1/2		BTS-2200	
R4	680Ω	1/2		BTS-680	
R5	220KΩ	1/2		BTS-220K	
R6	220KΩ	1/2		BTS-220K	
R7	330KΩ	1/2		BTS-330K	
R8	100KΩ	1/2		BTS-100K	
R9	22KΩ	1/2		BTS-22K	
R10	270Ω	1/2		BTS-270	
R11	12KΩ	1/2		BTS-12K	
R12	18KΩ	1/2		BTS-18K	
R13	33KΩ	1/2		BTS-33K	Note 1
R14	100KΩ	1/2		BTS-100K	Note 2
R15	220KΩ	1/2		BTS-220K	
R16	22KΩ	1/2		BTS-22K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA PENTRON PART No.	REPLACEMENT DATA IRC PART No.	NOTES
R17	10KΩ	1/2		BTS-10K	
R18	330Ω	1/2		BTS-330	Note 3
R19	100KΩ	1/2		BTS-100K	
R20	47KΩ	1/2		BTS-47K	
R21	150KΩ	1/2		BTS-150K	
R22	270Ω	1/2		BTS-270	
R23	680Ω	1/2		BTS-680	
R24	2.2Meg	1/2		BTS-2.2Meg	
R25	100KΩ	1/2		BTS-100K	
R26	15KΩ	1		BTA-15K	
R27	47KΩ	1 1/2		BTS-47K	
R28	47KΩ	1 1/2		BTS-47K	
R29	560Ω	2		BTB-560	
R30	1000Ω	1/2		BTS-1000	
R31	220KΩ	1/2		BTS-220K	Note 4

Note 1. Some models may use a 22KΩ resistor in this application.
Note 2. Some models may use a 68KΩ resistor in this application.
Note 3. Some mdoels may use a 390Ω resistor in this application.
Note 4. Not used in all models.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	REPLACEMENT DATA PENTRON PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC @.22A	510VCT .017ADC	6.3VCT @ 1.9A		TPC-1218	PM-8403 ①	P-3051①	R-8B ①	P9205 ①	T22R00①

① Tape 5 volt winding.

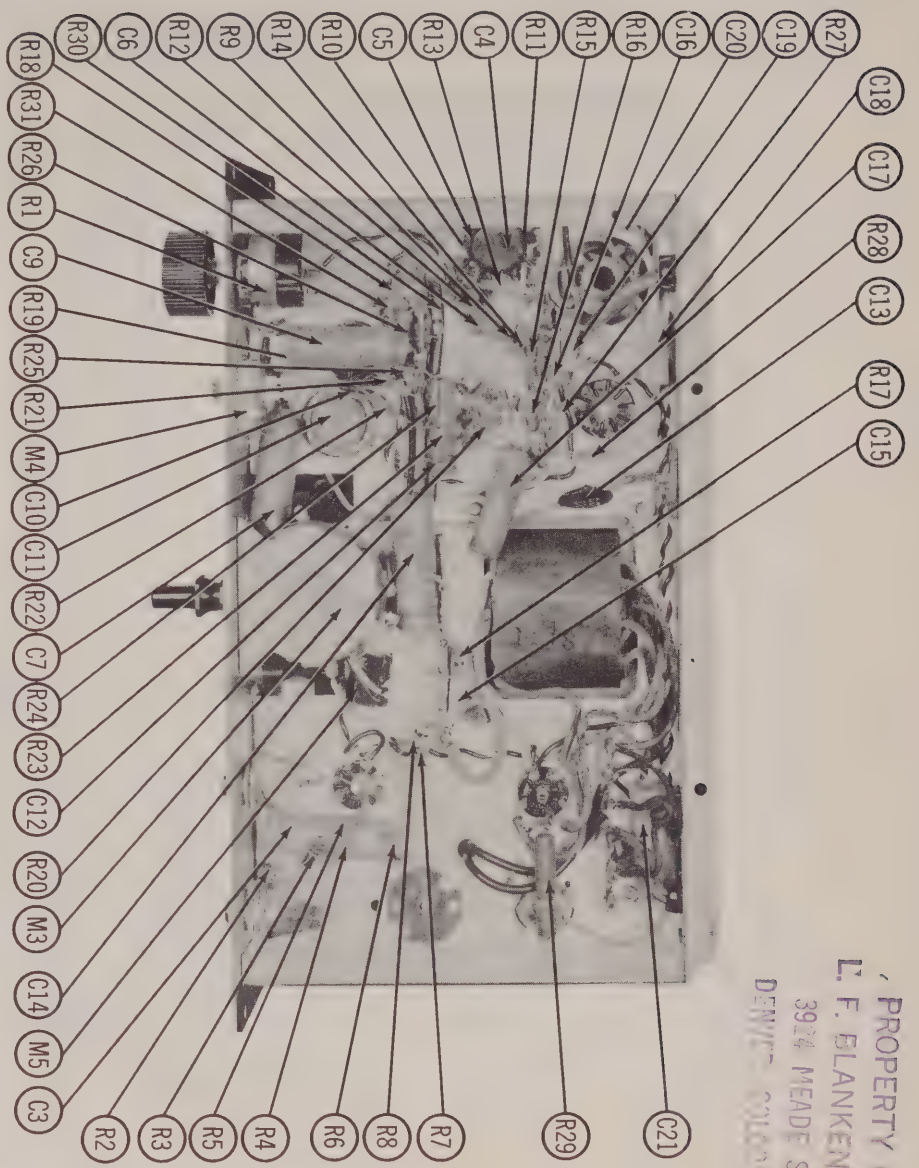
COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA PENTRON PART No.	REPLACEMENT DATA MEISSNER PART No.	REPLACEMENT DATA MERIT PART No.	REPLACEMENT DATA MILLER PART No.	NOTES
L1	Bias Osc. Coil	1Ω	16Ω					Pri. tapped @ 5Ω

MISCELLANEOUS

ITEM No.	PART NAME	PENTRON PART No.	NOTES
M1	Dial Light		Meter(#47 Bayonet)
M2	Switch		Motor Power (Toggle)
M3	Switch		Play-record
M4	Switch		Flat-Comp. (Slide)
M5	Rectifier		Meter
M6	Meter		Recording level

CHASSIS—BOTTOM VIEW



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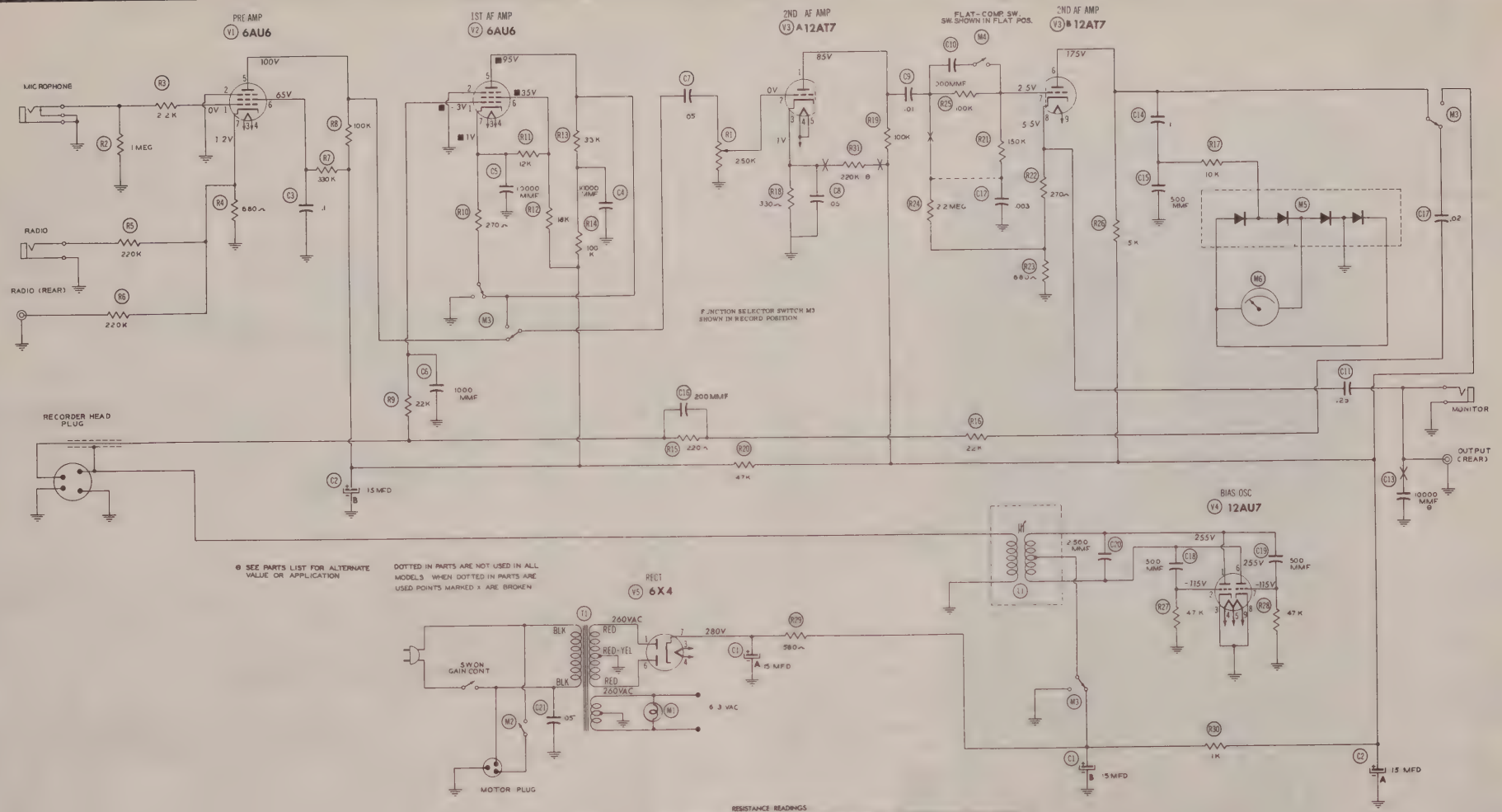
PENTRON
MODEL HFP-1



Ω SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DOTTED IN PARTS ARE NOT USED IN ALL MODELS. WHEN DOTTED IN PARTS ARE USED POINTS MARKED x ARE BROKEN

RESISTANCE READINGS

from	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6AU6	2.2KΩ	0Ω	.1Ω	.1Ω	†150KΩ	†380KΩ	680Ω		
V 2	6AU6	INF	0Ω	.1Ω	.1Ω	†■180KΩ	†65KΩ	■270Ω		
V 3	12AT7	†100KΩ	250KΩ	330Ω	.1Ω	.1Ω	†16.5KΩ	2.3Meg	950Ω	.1Ω
V 4	12AU7	†580Ω	47KΩ	0Ω	.1Ω	.1Ω	†580Ω	47KΩ	0Ω	.1Ω
V 5	6X4	35Ω	INF	.1Ω	.1Ω	INF	35Ω	60KΩ		

ALL MEASUREMENTS TAKEN IN RECORD POSITION UNLESS OTHERWISE DESIGNATED
■ MEASURED IN PLAY POSITION
† MEASURED FROM PIN 7 OF V5

1. DC voltage measurements taken with vacuum tube voltmeter. AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Normal tolerance of component values makes possible a variation of ± 10% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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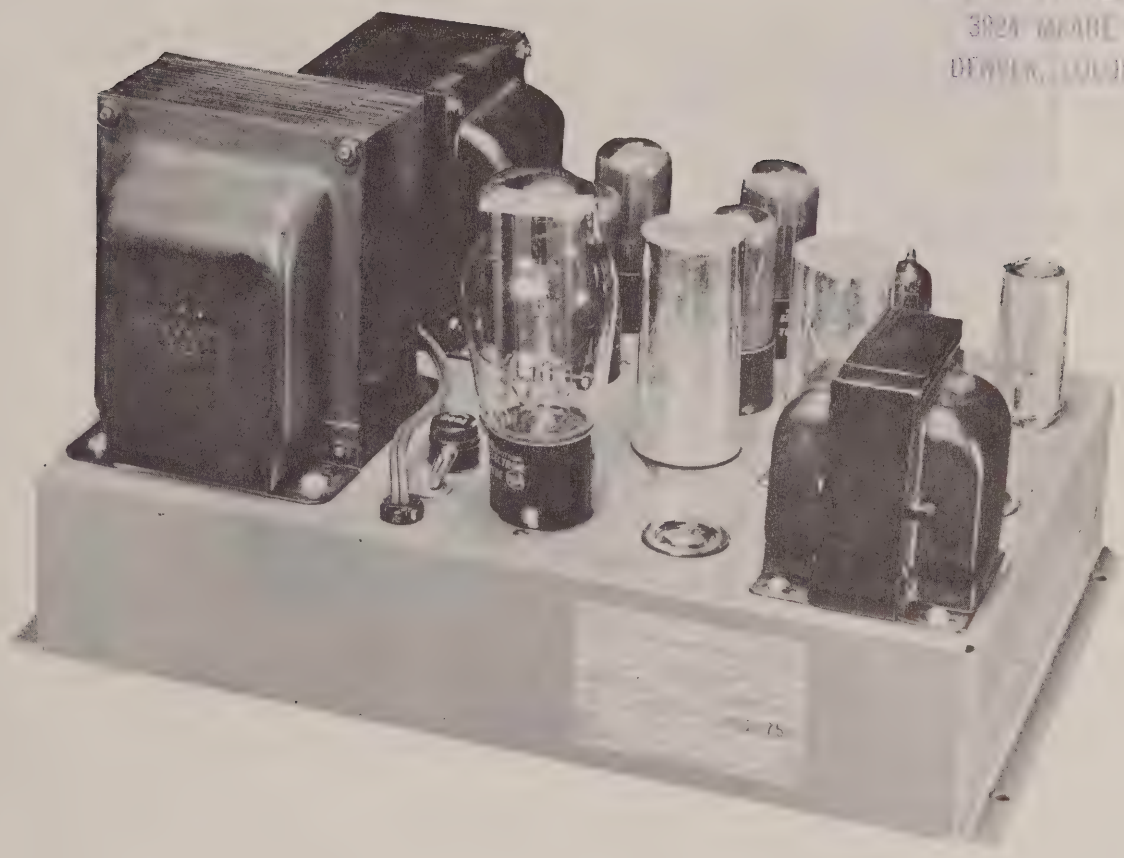
RCA VICTOR
MODEL SP-20 (MI-12191)



RCA VICTOR
MODEL SP-20 (MI-12191)

TRADE NAME	RCA Victor Model SP-20 (MI-12191)
MANUFACTURER	RCA Victor Div., Eng. Products Dept., Radio Corp. of America, Camden, N.J.
TYPE SET	AC Operated 20 Watt Audio Amplifier
TUBES (Eight)	Types 12AU7 AF Amp.-Phase Inv., (2) 6AU6 Drivers, (4) 6V6GT Audio Output, 5U4G Rectifiers
POWER SUPPLY	105-125 Volts 50/60 Cycles RATING 1.35 Amp. @ 117 Volts AC

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PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: RCA Victor PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	AF Amp.–Phase Inverter	12AU7	12AU7	9A	
V2	Driver	6AU6	6AU6	7BK	
V3	Driver	6AU6	6AU6	7BK	
V4	Audio Output	6V6GT	6V6GT	7S	
V5	Audio Output	6V6GT	6V6GT	7S	
V6	Audio Output	6V6GT	6V6GT	7S	
V7	Audio Output	6V6GT	6V6GT	7S	
V8	Rectifier	5U4G	5U4G	5T	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: RCA Victor PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	▲40	450	58567	AFH2-57		B045		FP238	TVL-2764	
B	▲45	450								
C2A	▲40	450	58567	AFH2-57		B045		FP238	TVL-2764	
B	▲40	450								
C3A	■100	50	98645	AFH2-06				FP116		
B	▲100	50		PRS50/100				TC3501		
C4	.47	200	73787	P288-47		PJ2P47		PT4047	2TM-P47	
C5	680	500	39648			1W5T68			MS-37	
C6	.1	400		P488-1		CUB4P1		PT401	4TM-P1	
C7	.1	400		P488-1		CUB4P1		PT401	4TM-P1	
C8	.047	400	78553	P488-047	DF-503	CUB4S47		PT4147	4TM-S47	
C9	.047	400	78553	P488-047	DF-503	CUB4S47		PT4147	4TM-S47	

CONTROLS

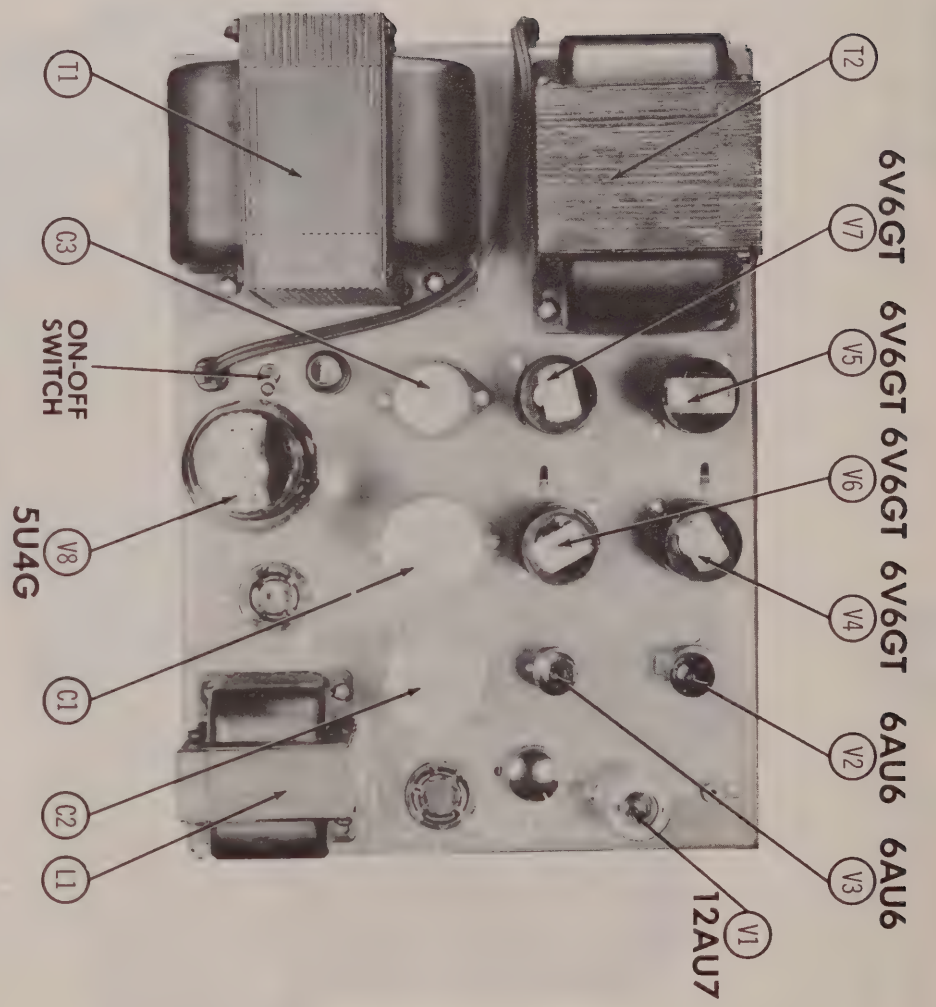
ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: RCA Victor PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	100KΩ	2	98647	Q11-128	A47-100K-S	B-40	U-41	Max. input volt Adj.
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: RCA Victor PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R2	4700Ω	½	502247	BTS-4700	
R3	6800Ω 5%	½	502268	BTS-6800 5%	
R4	220KΩ 5%	½	502422	BTS-220K 5%	
R5	39KΩ ½%	1	98642		
R6	39KΩ ½%	1	98642		
R7	1 Meg 5%	½	502510	BTS-1Meg 5%	
R8	330KΩ 5%	½	502433	BTS-330K 5%	
R9	1800Ω ½%	1	98643		
R10	1 Meg 5%	½	502510	BTS-1 Meg 5%	
R11	100KΩ ½%	2	98640		
R12	330KΩ 5%	½	502433	BTS-330K 5%	
R13	1 Meg 5%	½	502510	BTS-1 Meg5%	
R14	330KΩ 5%	½	502433	BTS-330K 5%	
R15	1800Ω ½%	1	98643		
R16	100KΩ ½%	2	98640		
R17	330KΩ 5%	½	502433	BTS-330K 5%	
R18	10KΩ	½	502310	BTS-10K	

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: RCA Victor PART No.	REPLACEMENT DATA: IRC PART No.	NOTES
R19	4700Ω	½	502247	BTS-4700	
R20	270KΩ	½	502427	BTS-270K	
R21	510Ω 5%	2	59069		
R22	510Ω 5%	2	59069		
R23	22Ω	½	502022	BTS-22	
R24	4700Ω	½	502247	BTS-4700	
R25	22Ω	½	502022	BTS-22	
R26	4700Ω	½	502247	BTS-4700	
R27	510Ω 5%	2	59069		
R28	510Ω 5%	2	59069		
R29	22Ω	½	502022	BTS-22	
R30	4700Ω	½	502247	BTS-4700	
R31	22Ω	½	502022	BTS-22	
R32	10KΩ	2	522310	BTB-10K	
R33	120KΩ	2	522412	BTB-120K	
R34	120KΩ	2	522412	BTB-120K	
R35	270KΩ	½	502427	BTS-270K	

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (POWER)

ITEM No.	RATING				REPLACEMENT DATA					
	PRI.	SEC. 1	SEC. 2	SEC. 3	RCA Victor PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
T1	117VAC	680VCT @ 1.35A	5VAC @ 3A	6.3VCT @ 2.8A	98680		P-3165 ①③	R-20A ①	P9318①②	

① Drill new mounting holes.
② Tape 5V center tap.
③ Tape 5V @ 2A and 6.3V @ .6A windings.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	RCA Victor PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	
T2	4.5KΩ CT	16Ω Tap @ 8Ω & 4Ω	98685		A-3100	S-35A ①	H4101 ①	22S95 ①	① Drill new mounting hole.

FILTER CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA					
	TOTAL DIRECT CURRENT	D. C. RESISTANCE	INDUCTANCE (0 CURRENT 1000 ~)	RCA Victor PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L1	.200A	60Ω	3.3 Hy.	98646		C-3196	C-14A ①	C5031 ①	20C55①

① Drill new mounting holes.

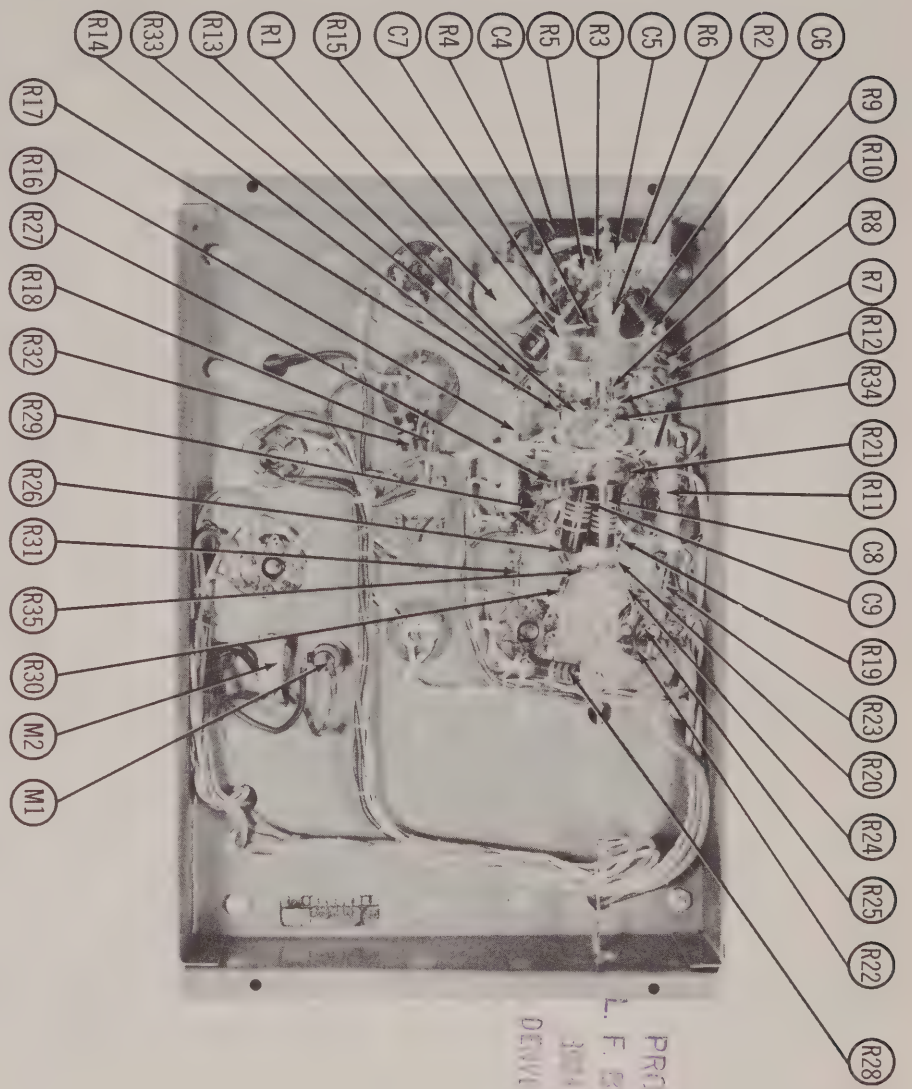
FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA					
			RCA Victor PART No.		LITTELFUSE PART No.		BUSS PART No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOLDER
M1	3AG S/B	2A 125V	93939	48894	313002 (3AG S/B-2A)	342001	MDL2	HKP

MISCELLANEOUS

ITEM No.	PART NAME	RCA Victor PART No.	NOTES
M2	Switch Knob	98641 72130	Power Input Control

CHASSIS—BOTTOM VIEW



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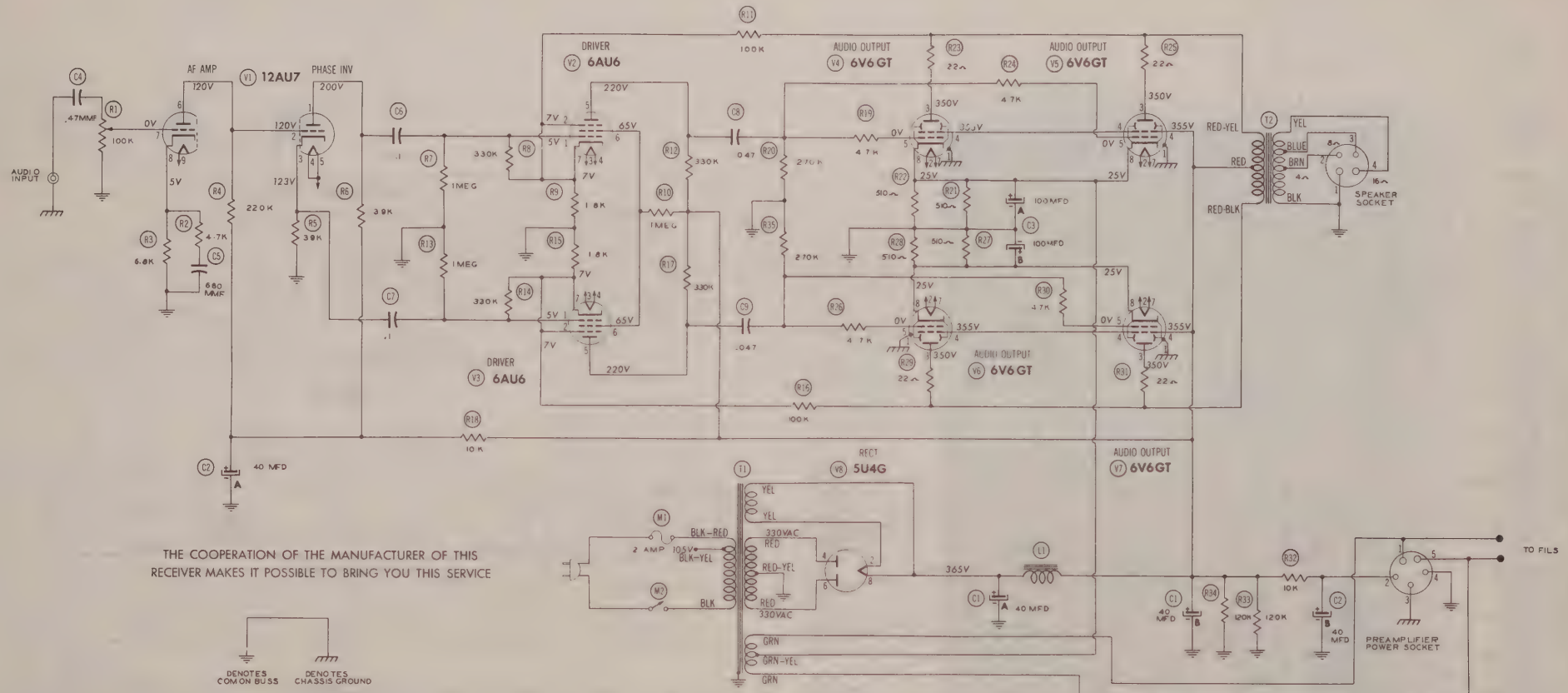
RCA VICTOR
MODEL SP-20 (MI-12191)



THE COOPERATION OF THE MANUFACTURER OF THIS RECEIVER MAKES IT POSSIBLE TO BRING YOU THIS SERVICE

DENOTES COMMON BUSS

DENOTES CHASSIS GROUND

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
1	12AU7	†49KΩ	†230KΩ	39KΩ	250Ω	255Ω	†230KΩ	100KΩ	6.8KΩ	255Ω
2	6AU6	330KΩ	1.8KΩ	255Ω	255Ω	†330KΩ	†1Meg	1.8KΩ		
3	6AU6	330KΩ	1.8KΩ	255Ω	255Ω	†330KΩ	†1Meg	1.8KΩ		
4	6V6GT	0Ω	255Ω	†137Ω	†62Ω	275KΩ	†25Ω	255Ω	255Ω	
5	6V6GT	0Ω	255Ω	†137Ω	†62Ω	275KΩ	INF	255Ω	255Ω	
6	6V6GT	0Ω	255Ω	†137Ω	†62Ω	275KΩ	INF	255Ω	255Ω	
7	6V6GT	0Ω	255Ω	†137Ω	†62Ω	275KΩ	INF	255Ω	255Ω	
8	5U4G	INF	30KΩ	INF	30Ω	INF	30Ω	INF	30KΩ	

† MEASURED FROM PIN 8 OF V8

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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RETMA MEMBER

SILVERTONE MODELS 3103A, 4107, A, 4110, 4111A, 4114A, B, C, 4124, 4126A, B, D, 4128A, B, 4132, 4139, 4142, 4144, 4149E (Ch. 528.290, -1, -2, 528.291, -1, -2, 528.297, 528.299, -1, -2, 528.302)

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MODEL 4107A

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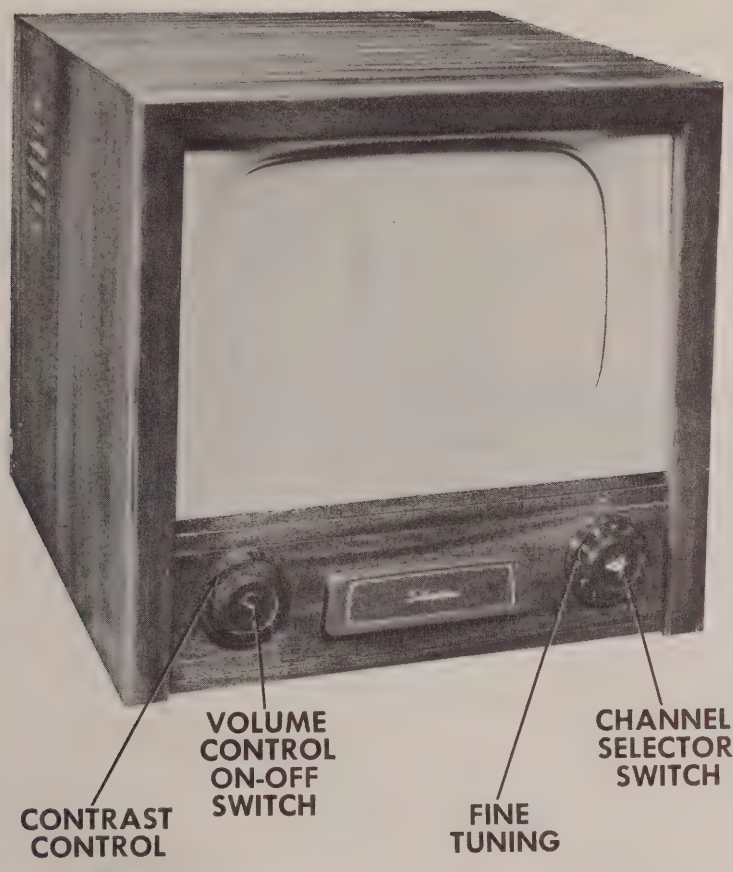

SILVERTONE MODEL 4107A (Ch. 528.290-1)

TRADE NAME	Silvertone	MODELS	CHASSIS
		3103A	528.290-2
		4107	528.290, -1
		4107A, 4124	528.290-1, -2
		4110, 4114C, 4126D, 4128B, 5111	528.302
		4111A	528.291, -1, -2
		4114A, 4128A	528.291
		4114B, 4126B	528.291-1, -2
		4126A	528.297
		4132	528.291-2
		4139A	528.299, -1, -2
		4142, 4144, 4149E	528.299-2

SUPPLIER	Sears Roebuck & Co., 925 S. Homan Ave., Chicago, Ill.
TYPE SET	Television Receiver
TUBES	Twenty-one
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING 1.6 Amp. @ 117 Volts AC
TUNING RANGE	Channels 2 thru 13, Video IF 26.25MC, Sound IF 21.75MC (Intercarrier)

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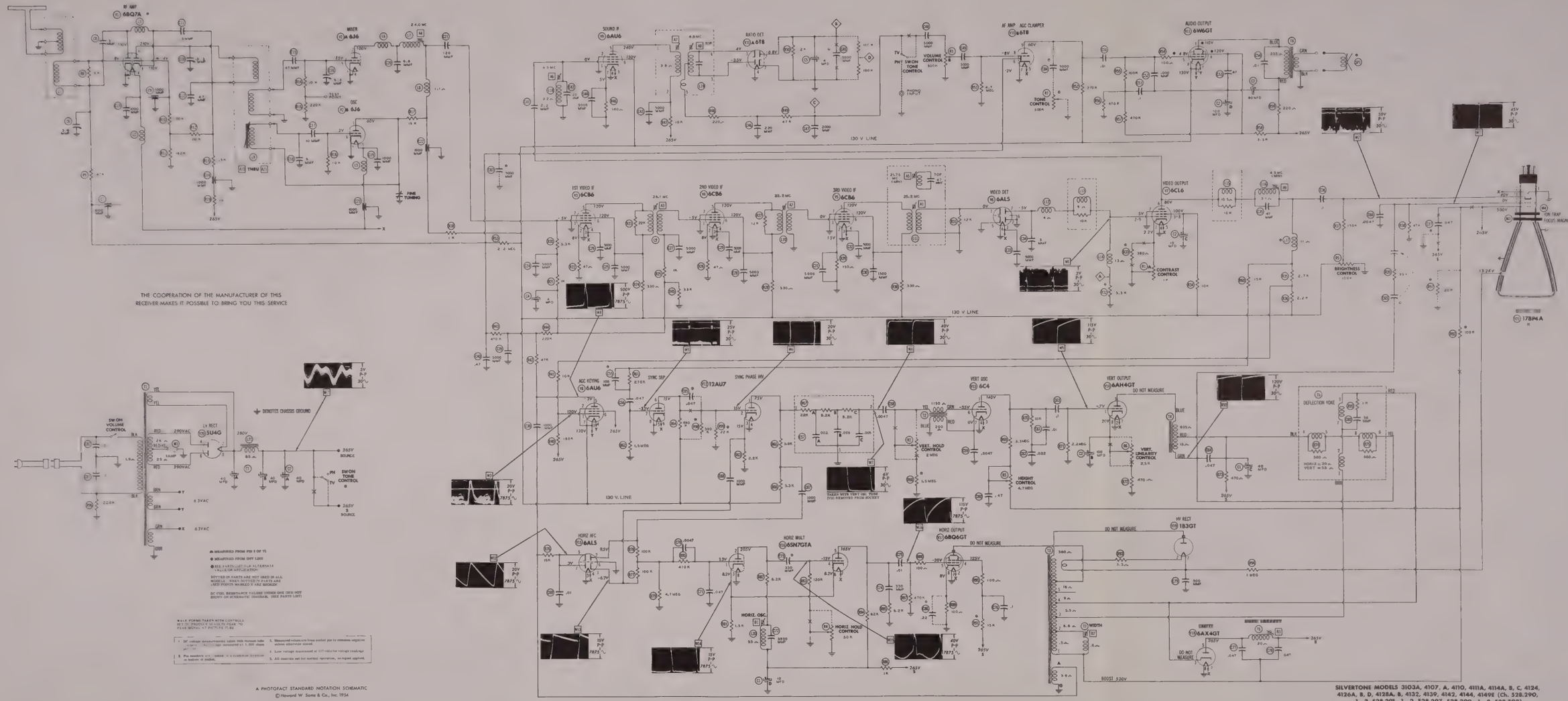
RF AMP V1 6BQ7A
MIXER V2 6J6
OSC V3 6J6
SOUND IF V9 6AU6
RATIO DET V10 6T8
AF AMP AGC CLAMPER V11 6T8
AUDIO OUTPUT V12 6W6GT
1ST VIDEO IF V5 6CB6
2ND VIDEO IF V6 6CB6
3RD VIDEO IF V7 6CB6
VIDEO DET V8 6AL5
VIDEO OUTPUT V17 6CL6
AGC RCTFR V4 6AU6
SYNC SEP V13 12AU7
SYNC PHASE INV
VERT OSC V14 6C4
VERT OUTPUT V15 6AH4GT
HORIZ AFC V16 6AL5
HORIZ MULT V18 6SN7GTA
HORIZ OUTPUT V19 6BQ6GT
HV RECT V19 1B3GT
DAMPER V20 6AX4GT
LV RECT V20 5U4G
PIX TUBE V21 17BP4A
SW ON VOLUME CONTROL
SW ON TONE CONTROL
VOLUME CONTROL 500K
TONE CONTROL 500A
CONTRAST CONTROL
BRIGHTNESS CONTROL
VERT. HOLD CONTROL 2 MEG
VERT. LINEARITY CONTROL 2.5 K
HEIGHT CONTROL 4.7 MEG
HORIZ. OSC.
HORIZ. HOLD CONTROL 50 K
WIDTH
DEFLECTION YOKE
FINE TUNING
130 V. LINE
DO NOT MEASURE
DENOTES CHASSIS GROUND
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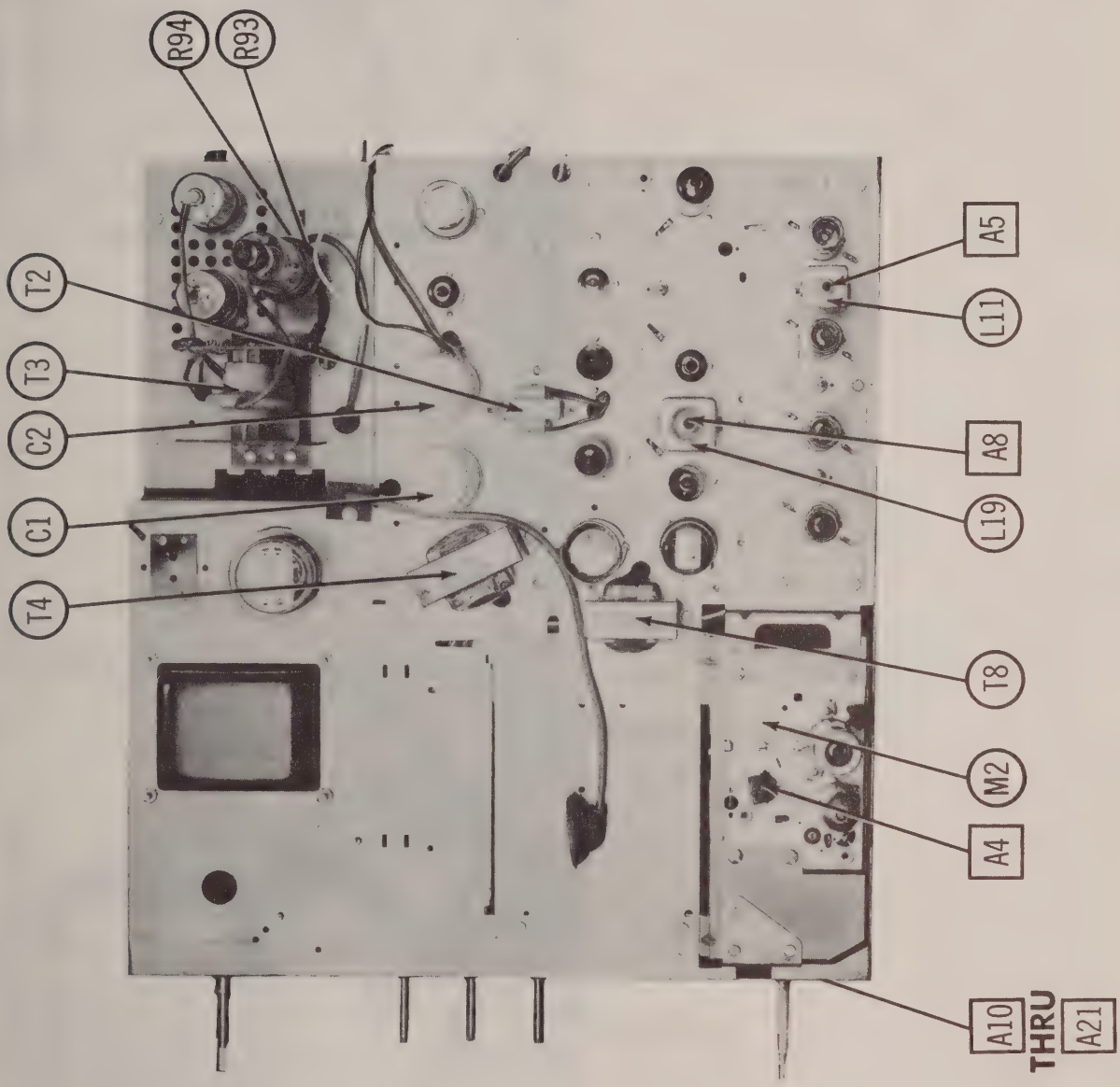

CHASSIS TOP VIEW

SILVERTONE MODELS 3103A, 4107, A, 4110, 4111A, 4114A, B, C, 4124, 4126A, B, D, 4128A, B, 4132, 4139, 4142, 4144, 4149E (Ch. 528.290, -1, -2, 528.291, -1, -2, 528.297, 528.299, -1, -2, 528.302)

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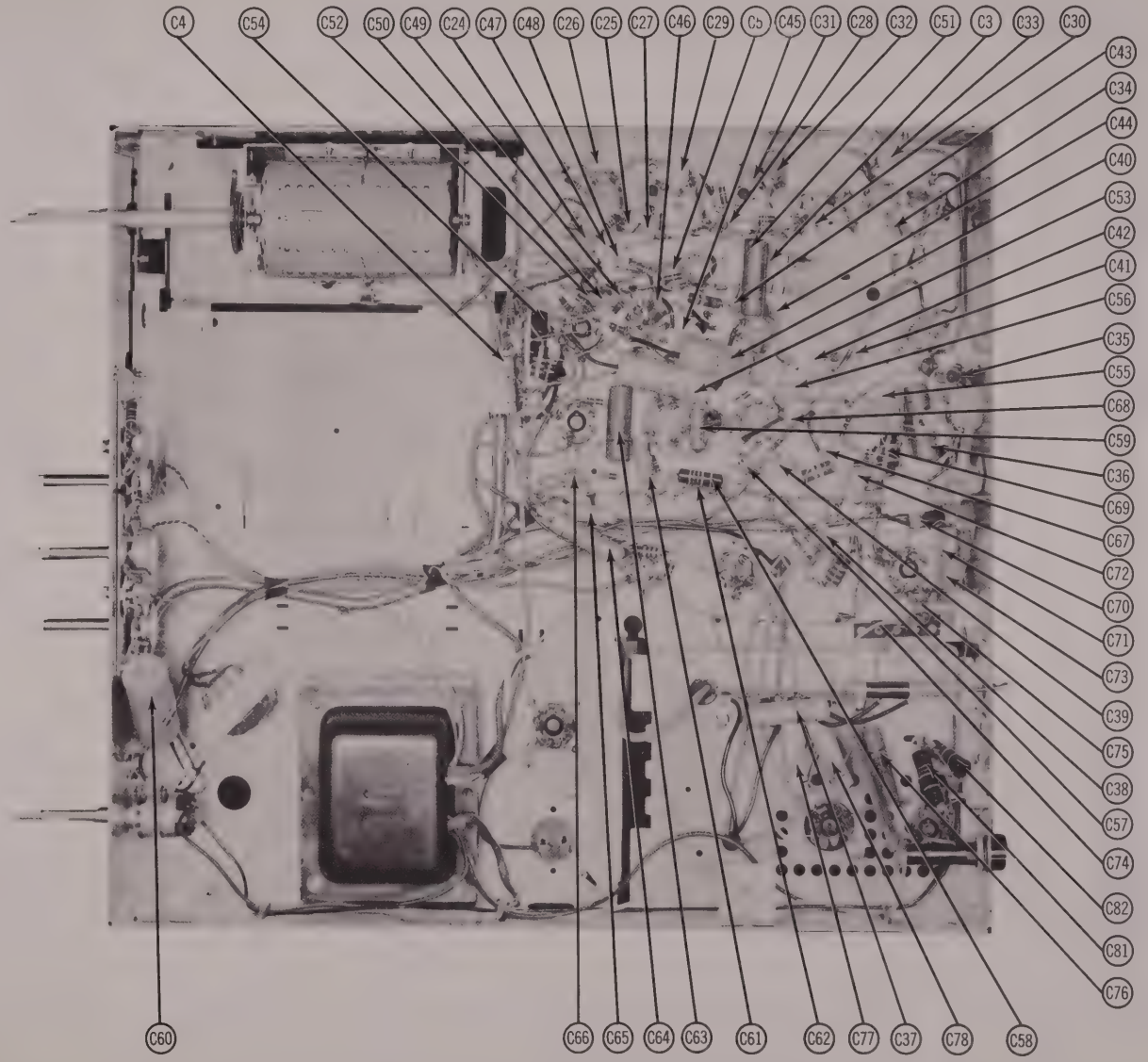
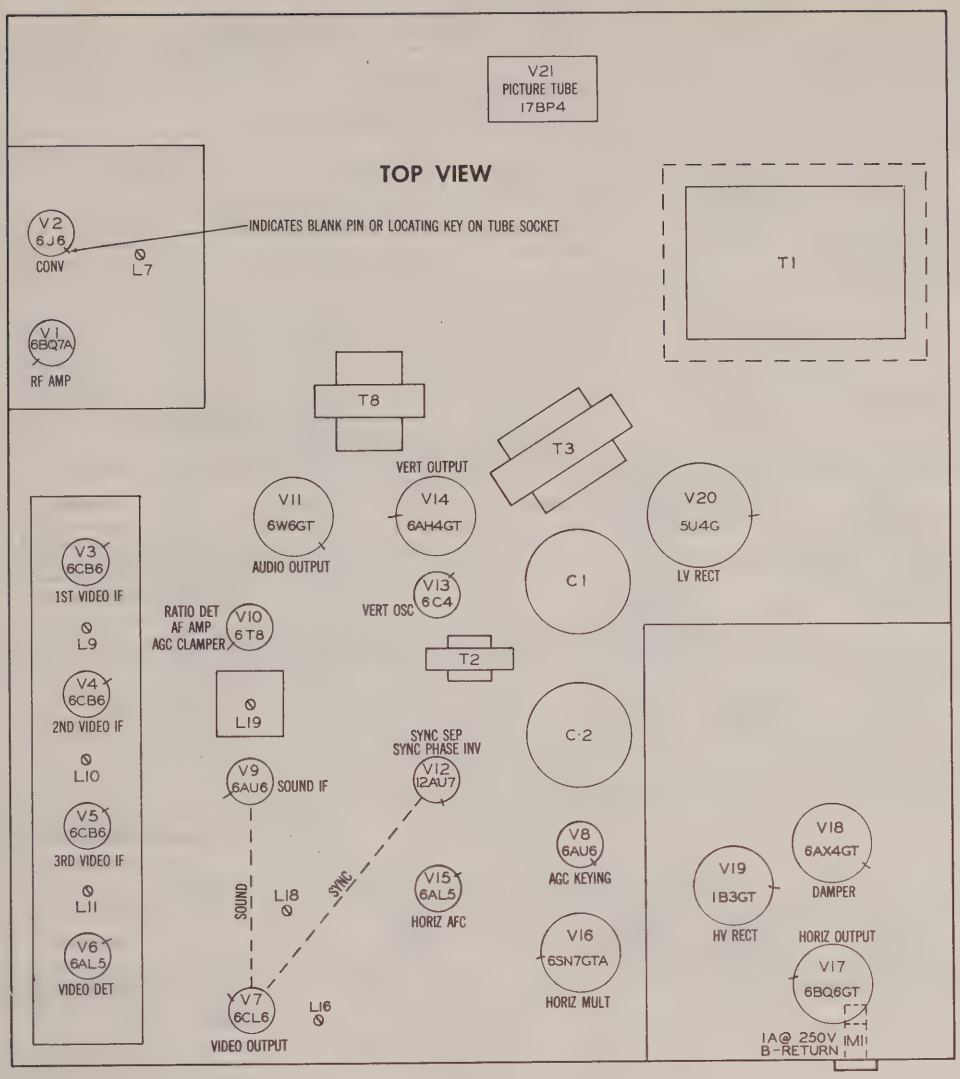


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

TUBE PLACEMENT CHART



TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - V20, Fuse (M1)

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V2, V3, V4, V5, V6, V7, V11
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V7, V21
Has pic, no sound - V9, V10, V11
Overloaded picture - V8, V10

SYNC FAILURE
No vert. sync - V12, V13
No horiz. sync - V12, V15, V16
No vert. or horiz. sync - V12

SWEEP FAILURE
No raster, has sound - V16, V17, V18, V19, V21
No vertical deflection - V13, V14
Poor vert. linearity or foldover - V13, V14
Poor horiz. linearity or foldover - V16, V17, V18
Narrow picture - V16, V17, V18, V19, V20
Vert. off freq. - V12, V13
Horiz. off freq. - V12, V15, V16

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage lead should be securely taped and kept away from the chassis. Do not remove the horizontal multivibrator tube (V16) from its socket, to disable the high voltage.

VIDEO IF ALIGNMENT

Remove the converter tube (V2) from its socket and replace with a 6J6 which has pin 1 removed.
Connect the negative lead of a 4.5 volt battery to the ungrounded side of C4. Connect the positive lead to chassis.
Attenuate generator output to maintain 2.5 volts on VTVM at point (A).

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
1.	Direct	High side to an ungrounded tube shield floating over dummy converter tube. Low side to chassis.	25.2MC (Unmod)	Any	DC probe to point (A). Common to chassis.	A1	Adjust for maximum deflection.
2.	"	"	23.2MC	"	"	A2	"
3.	"	"	26.1MC	"	"	A3	"
4.	"	"	24.0MC	"	"	A4	"
5.	"	"	21.75MC	"	"	A5	Adjust for MINIMUM deflection.

OVERALL VIDEO IF RESPONSE CHECK

Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
6.	Direct	High side to an ungrounded tube shield floating over dummy converter tube. Low side to chassis.	24MC (10MC Swp)	21.75MC 23.0MC 24.0MC 25.0MC 26.25MC	Any	Vert. Amp. thru 10KΩ to point (A). Low side to chassis.		Attenuate generator output for 2 volts peak to peak on scope. Check for response similar to Fig. 1. If necessary, retouch A1 thru A4 to obtain desired response.

SOUND IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Connect two matched 100KΩ (±1%) resistor in series from point (B) to chassis. The junction of these two resistors is alignment point (D) as shown on the schematic.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
7.	.01MFD	High side to point (A). Low side to chassis.	4.5MC (Unmod)	Any	DC probe to point (B). Common to chassis.	A6, A7	Adjust for maximum deflection.
8.	"	"	"	"	DC probe to point (C). Common to point (D).	A8	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60% modulation and 450KC sweep. Use 120% sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
7.	.01MFD	High side to point (A). Low side to chassis.	4.5MC (450KC Swp)	4.5MC	Any	Vert. Amp. to point (B). Low side to chassis.	A6, A7	Disconnect stabilizing capacitor C5. Adjust for response of maximum amplitude and symmetry similar to Fig. 2.
8.	"	"	"	"	"	Vert. Amp. to point (C). Low side to chassis.	A8	Reconnect stabilizing capacitor C5. Adjust so that 4.5MC occurs at center of crossover lines as in Fig. 3. SLIGHTLY retouch A7 for maximum amplitude and straightness of crossover lines.

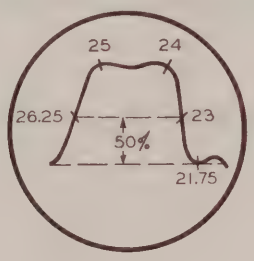


FIG. 1

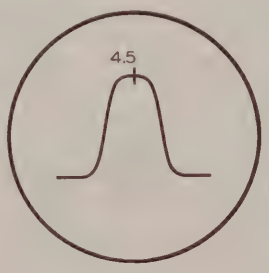


FIG. 2

ALIGNMENT INSTRUCTIONS (cont)

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4.5MC TRAP ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
9.	.01MFD	High side to pin 11 (cathode) of picture tube. Low side to chassis.	4.5MC (Unmod)	Any	DC probe to point (B). Common to chassis.	A9	Adjust for MINIMUM deflection.

ALTERNATE 4.5MC TRAP ALIGNMENT

Tune in a TV station and adjust A9 for minimum 4.5MC beat interference in the picture.

OSCILLATOR ALIGNMENT

Remove the dummy converter tube and replace the original 6J6 in its socket.
Leave the bias battery connected as under "Video IF Alignment".
The channel oscillator adjustment screws are reached through a hole just to the right of the channel switch shaft. The correct adjustment screw is accessible through this hole as the channel switch is turned to each channel.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10.	Two 120Ω Carbon Resistors	Across antenna terminals with 120Ω in each lead.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 10KΩ to point (A). Low side to chassis.	A10	Adjust to place sound marker in trap notch as in Fig. 4. Video marker should be at 50%.
			207MC (10MC Swp)	205.25MC 209.75MC	12		A11	
			201MC (10MC Swp)	199.25MC 203.75MC	11		A12	
			195MC (10MC Swp)	193.25MC 197.75MC	10		A13	
			189MC (10MC Swp)	187.25MC 191.75MC	9		A14	
			183MC (10MC Swp)	181.25MC 185.75MC	8		A15	
			177MC (10MC Swp)	175.25MC 179.75MC	7		A16	
			85MC (10MC Swp)	83.25MC 87.75MC	6		A17	
			79MC (10MC Swp)	77.25MC 81.75MC	5		A18	
			69MC (10MC Swp)	67.25MC 71.75MC	4		A19	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A20	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A21	

RF AND MIXER ALIGNMENT

The RF and mixer portion of this receiver has been properly aligned at the factory and is very stable. Alignment of this portion should not be required in the field.

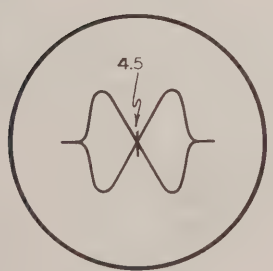


FIG. 3

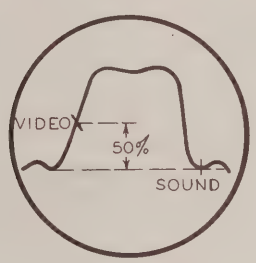


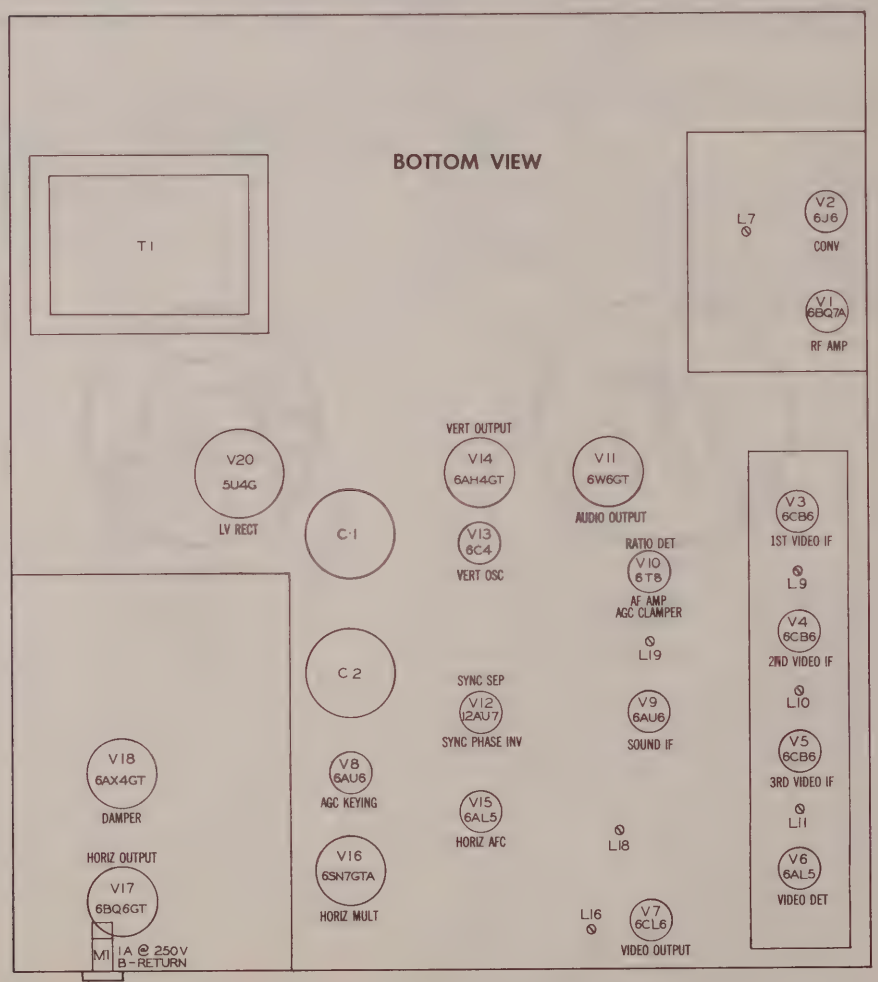
FIG. 4

SILVERTONE MODELS 3103A, 4107, A, 4110, 4111A, 4114A, B, C, 4124, 4126A, B, D, 4128A, B, 4132, 4139, 4142, 4144, 4149E (Ch. 528.290, -1, -2, 528.291, -1, -2, 528.297, 528.299, -1, -2, 528.302)

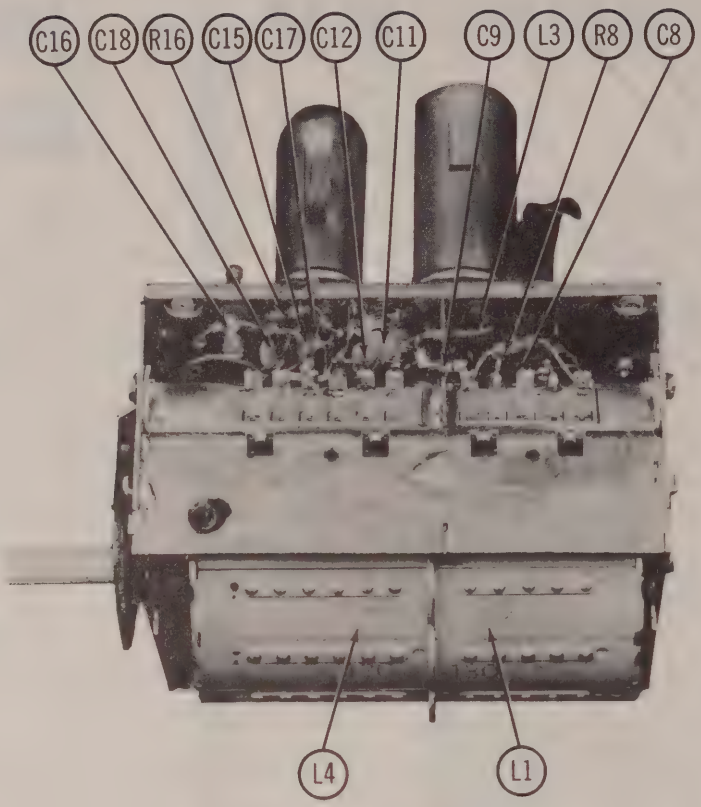
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BQ7A	INF	785KΩ	0Ω	.1Ω	0Ω	†2.5KΩ	180KΩ	INF	
V 2	6J6	▲16KΩ	▲1KΩ	.1Ω	0Ω	230KΩ	10KΩ	0Ω		
V 3	6CB6	37KΩ	47Ω	0Ω	.1Ω	▲330Ω	▲330Ω	0Ω		
V 4	6CB6	34KΩ	47Ω	0Ω	.1Ω	▲330Ω	▲330Ω	0Ω		
V 5	6CB6	.3Ω	150Ω	0Ω	.1Ω	▲330Ω	▲330Ω	0Ω		
V 6	6AL5	.5Ω	0Ω	.1Ω	0Ω	0Ω	0Ω	3.3KΩ		
V 7	6CL6	200Ω	3.3KΩ	▲10KΩ	0Ω	.1Ω	▲5KΩ	0Ω	▲10KΩ	3.3KΩ
V 8	6AU6	70KΩ	70KΩ	70KΩ	70KΩ	300KΩ	30KΩ	70KΩ		
V 9	6AU6	3.2Ω	0Ω	.1Ω	0Ω	†10KΩ	▲0Ω	560Ω		
V 10	6T8	INF	12KΩ	INF	0Ω	.1Ω	720KΩ	0Ω	4.7Meg	▲270KΩ
V 11	6W6GT	INF	70KΩ	†540Ω	†3.3KΩ	350KΩ	250KΩ	70KΩ	70KΩ	
V 12	12AU7	▲7KΩ	▲680KΩ	2.2KΩ	0Ω	0Ω	▲680KΩ	1.5Meg	0Ω	.1Ω
V 13	6C4	▲5Meg	INF	.1Ω	0Ω	▲5Meg	2.4Meg	200Ω		
V 14	6AH4GT	2.2Meg	0Ω	INF	INF	†1.2KΩ	INF	.1Ω	1KΩ	
V 15	6AL5	4.8Meg	4.8Meg	0Ω	.1Ω	15KΩ	0Ω	15KΩ		
V 16	6SN7GTA	5Meg	†9KΩ	1.5KΩ	160KΩ	†583KΩ	1.5KΩ	.1Ω	0Ω	
V 17	6BQ6GT	INF	.1Ω	470KΩ	†15KΩ	470KΩ	†15KΩ	0Ω	100Ω	TOP CAP 17Ω
V 18	6AX4GT	INF	INF	INF	INF	†100Ω	†0Ω	.1Ω	0Ω	
V 19	1B3GT		PINS	1 - 8	HAVE	INF	RESISTANCE			TOP CAP 377Ω
V 20	5U4G	INF	30KΩ	INF	26Ω	INF	25Ω	INF	30KΩ	
V 21	17BP4A	0Ω	47KΩ	PIN 10 ▲100KΩ	PIN 11 ▲200KΩ	PIN 12 .1Ω				

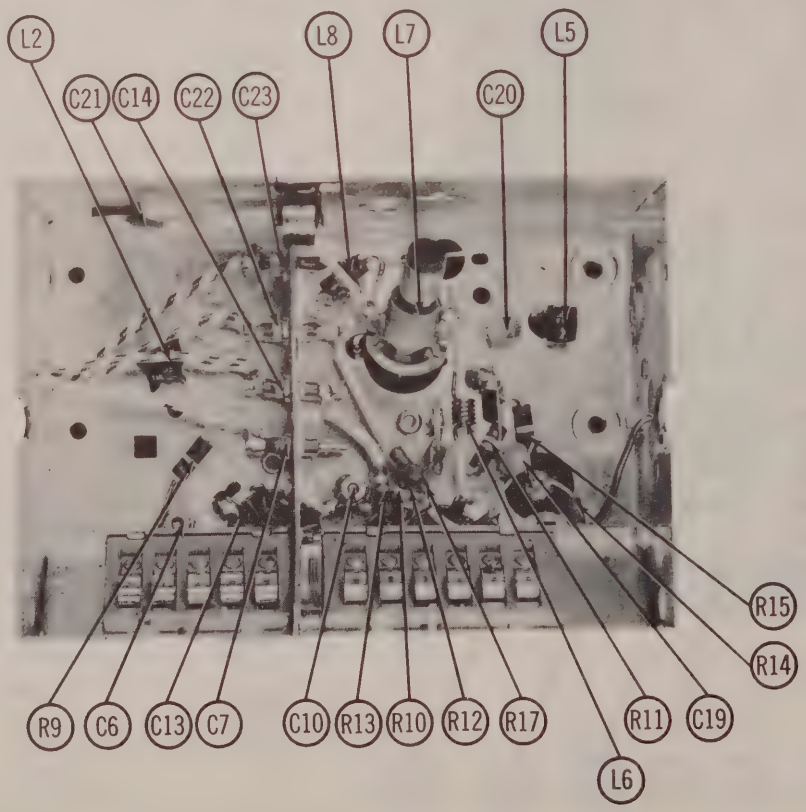
† MEASURED FROM PIN 8 OF V20
▲ MEASURED FROM 130V LINE
▲ MEASURED FROM PIN 3 OF V18



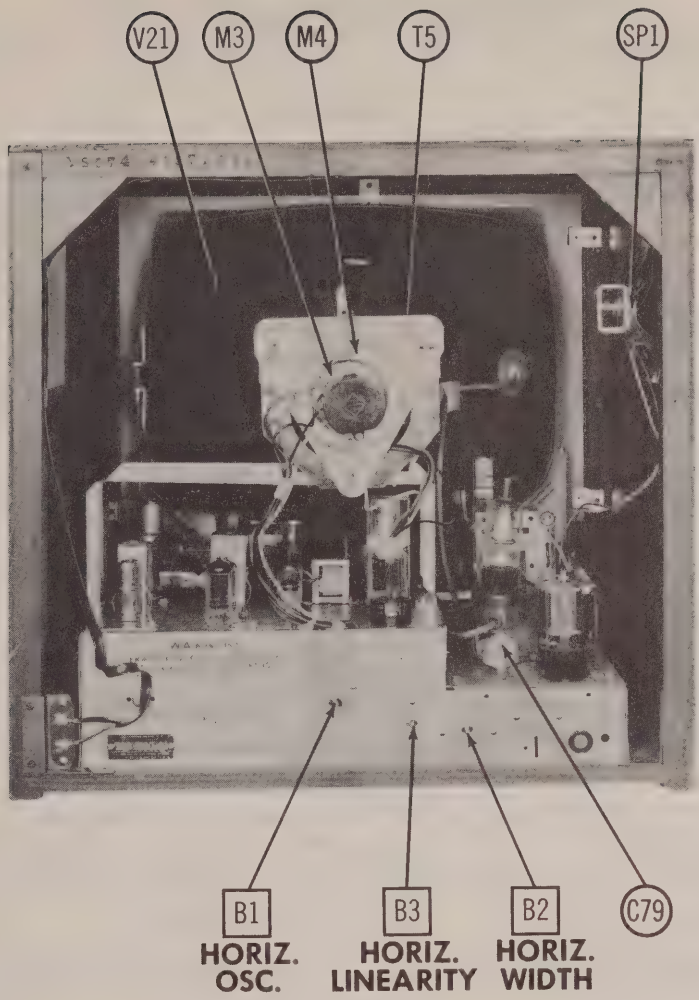
TUBE PLACEMENT CHART



RF TUNER-RIGHT SIDE



RF TUNER-BOTTOM VIEW



CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

Set the horizontal hold control it its mid-range position and adjust the horizontal oscillator slug (B1) until the picture synchronizes horizontally.

Momentarily remove signal by switching off channel and back again. If picture does not immediately fall into sync SLIGHTLY retouch B1. Repeat procedure until best picture lock-in is obtained on all channels.

Adjust the width coil slug (B2) for a picture that is SLIGHTLY wider than necessary to fill the picture mask horizontally.

Adjust the horizontal linearity coil slug (B3) for a picture that is symmetrical from left to right.

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage".

INSUFFICIENT SWEEP

Adjust B2 and B3. Check by substitution V17, V18 and V20. Check T3, T5A, R91 and other associated components.

DRIVE LINES

Adjust B2 and B3. Check by substitution V17 and V18. Check T3, T5A, C75, C74, R85, R88 and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V17 and V18. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V16, V17 and V18. Check C71 for open. Check other components associated with V16.

XMAS TREE EFFECT

Check by substitution V16, V17 and V18. Check T3 and T5A for arcing. Check C73, C76, R85, C72, L20 and other associated components.

VERTICAL

LOSS OF SWEEP

Check by substitution V13 and V14. Check waveform W9.

If Satisfactory	If Unsatisfactory
Check T4, T5B, C64, C2B, C1C and other associated components.	Check T2, C63, R69, R3 and other associated components.

INSUFFICIENT SWEEP

Check by substitution V13 and V14. Check height and vertical linearity controls for proper adjustment. Check T2, T4, T5B and other associated components.

COMPRESSED AT BOTTOM

Check by substitution V13 and V14. Check C60, R69, R3 and other associated components.

COMPRESSED AT TOP

Check by substitution V13 and V14. Check C2B, R6, R72 and other associated components.

FOLDS

Check by substitution V13 and V14. Check C61, C62, R70, T4, T5B and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V12. Check R60, R61, C55, C56, R66, R65 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Check by substitution V12 and V13. Check C58, R2, R68, check vertical integrator network and other associated components.

LOSS OF HORIZONTAL SYNC-VERTICAL SYNC SATISFACTORY

Check by substitution V15 and V16. Check C67, C68, C69, C70, C71, R76 and other associated components.

HORIZONTAL BENDING

Check by substitution V8, V12, V15 and V16. Check horizontal AFC network for component failure or change of value.

VIDEO

LOSS OF VIDEO

Substitute V7. Check R34, R36, R35, L17, L15, C36, C35 and other associated components.

SOUND BARS (4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A9. Check video IF alignment.

POOR CONTRAST

Substitute V7. Check contrast control, picture tube, L14, R33 and C36. Check video detector network.

NEGATIVE PICTURE

Check by substitution V6 and V7. Check picture tube. Check video detector and video IF components.

SMEAR

Substitute V7. Check L12, L13, L14, L17, L15, C36, C35, picture tube and other associated components.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V3, V4, V5, V6 and V7. Check V8, V1 and V2 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V9, V10 and V11. Check audio stages V10 and V11 using audio signal generator. Apply audio signal across R18.

If Satisfactory	If Unsatisfactory
Check ratio detector and audio IF stages for component failure or change of value.	Check C49, C50, C54, C52, R58, R52, R59, T8, speaker and other associated components.

BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustments A8 for minimum buzz. If still unsatisfactory check ratio detector and audio IF alignment.

DISTORTED

Follow procedure outlined under "Weak or No Sound".

POWER

DEAD SET

If filaments fail to light, check AC interlock assembly, check switch on volume control and T1. If filaments light check M1 and V20 by substitution. Check B+ filter and decoupling network for component failure or change of value.

SMALL AND/OR DIM PICTURE

Substitute V20. Check B+ filter and decoupling network.

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: Silvertone PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amplifier	6BQ7A	6BQ7A	9AJ	6BZ7 used in some sets
V2	Converter	6J6	6J6	7BF	
V3	1st. Video IF Amp.	6CB6	6CB6	7CM	
V4	2nd. Video IF Amp.	6CB6	6CB6	7CM	
V5	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V6	Video Detector	6AL5	6AL5	6BT	
V7	Video Output	6CL6	6CL6	6CL6	
V8	AGC Keying	6AU6	6AU6	7BK	
V9	Sound IF Amp.	6AU6	6AU6	7BK	
V10	Ratio Det-AF Amp-AGC Clamper	6T8	6T8	9E	
V11	Audio Output	6W6GT	6W6GT	7S	
V12	Sync Separator-Sync Phase Inv.	12AU7	12AU7	9A	
V13	Vert. Oscillator	6C4	6C4	6BG	
V14	Vert. Output	6AH4GT	6AH4GT	8EL	
V15	Horiz. AFC	6AL5	6AL5	6BT	
V16	Horiz. Mult.	6SN7GTA	6SN7GTA	8BD	
V17	Horiz. Output	6BQ6GT	6BQ6GT	6AM	
V18	Damper	6AX4GT	6AX4GT	4CG	
V19	HV Rectifier	1B3GT	1B3GT	3C	
V20	LV Rectifier	5U4G	5U4G	5T	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: Silvertone PART No.	CBS-HYTRON PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V21	17BP4A	17BP4A	17BP4A	17BP4A	17BP4A	12N	
	17BP4	17BP4	17BP4	17BP4	17BP4	12D	
			17BP4B	17BP4B		12N	
	21WP4	21WP4		21WP4		12N	
				21WP4A		12N	
	21ZP4			21ZP4	21ZP4	12D	
				21ZP4A		12N	
				21ZP4B		12N	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: Silvertone PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	▰40	350	T18-310	AFH3-44		C035		FP376.8	TVL-3787	
B	▲40	350		PRS350/10		BR1045		TC78	TVA-1604	
C	■40	350								
D	10	350								
C2A	▰40	350	T18-311	AFH4-120		D101		FP423.4	TVL-3762	
B	100	50							TVA-1310	
C	■10	350								
D	▲100	200								
C3	60	200	T18-809	PRS250/30-30		BR6025		TC68	TVA-1613	
C4	4	50	T18-392	PRS150/4		BR505		TC30	TVA-1303	
C5	4	50	T18-392	PRS150/4		BR505		TC30	TVA-1303	
C6	3-9				829-10		3139-01-1R5			
C7	1000			EF-001	MFT-1000				503C-D1	
C8	3			SI3.3NP0	TCZ-3	Z007	NP0K-030	ZT-5533	5TCCB-V33	
C9	1000			EF-001	MFT-1000				503C-D1	
C10	.5-3				829-3		3115-01-0R5	CT565A		
C11	1.5			SI1.5NP0	TCZ-1.5	Z004	NP0K-1R5	ZT-5515	5TCCB-V15	
C12	47									
C13	1000			BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C14	1000			EF-001	MFT-1000				503C-D1	
C15	47			BPD-000047	D6-470	G033	801-470	UC-5447	5GA-Q47	
C16	.5-3				829-3		3115-01-0R5	CT565A		
C17	10			SI10NP0	TCZ-10	Z018	NP0K-100	ZT-541	5TCC-Q1	
C18	5									
C19	1000			BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C20	6.8			SI6.8NP0	TCZ-6.8	Z013	NP0K-6R8	ZT-5568	5TCCB-V68	
C21	120			BPD-00012	D6-121	G044	GP2K-121	UC-5312	5GA-T12	
C22	1000			EF-001	MFT-1000				503C-D1	
C23	1000			EF-001	MFT-1000				503C-D1	
C24	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C25	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C26	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C27	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C28	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C29	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C30	1500		T16-241	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C31	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C32	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C33	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C34	5		T15-222	SI5NP0	TCZ-4.7	Z011	NP0K-050	ZT-555	5TCCB-V47	
C35	47			SI47NP0	TCZ-47	TZ22	NP0K-470	ZT-5447	5TCC-Q47	
C36	.1	400	T16-244	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C37	.047	600	T16-235	P688-047	DF-503	CUB6S47		PT6147	6TM-S47	Note 1
C38	1000		T15-220	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C39	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C40	.47	200	T16-240	P288-47		CUB2P47		PT4047	2TM-P47	
C41	2.2									
C42	20			SI20NP0	TCZ-20	Z023	NP0K-200	ZT-542	5TCC-Q2	
C43	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C44	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C45	5000		T16-277	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	Note 1
C46	220	500	T15-218	1469-00025		22R5T22		MCB240		
C47	2000		T15-228	BPD-002	DD-202	K072	801-002	DC-522	5HK-D2	
C48	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	Note 2
C49	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C50	.01	400	T16-247	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C51	.1	400	T16-244	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C52	1000		T15-220	BPD-001	DD-102	K069	801-001	DC-521	5HK-S1	
C53	.47	200	T16-240	P288-47		CUB2P47		PT4047	2TM-P47	

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	Silvertone Part No.	AEROVOX Part No.	CENTRALAB Part No.	CORNELL-DUBILIER Part No.	ERIE Part No.	MALLORY Part No.	SPRAGUE Part No.	NOTES
C54	.01	600	T16-237	P688-01	D6-103	CUB681	GP2-333-103	PT611	5TM-81	
C55	100			5U100	D6-101	TP34	GP1K-101	UC-531	5GA-T1	Note 4
C56	.047	400	T16-245	P488-047	DF-503	CUB4847		PT4147	4TM-847	
C57A	.002							PT6321		
B	.005		*T17-109	*PA-110	*PC-100	*1157M1	*1405-01	PT625	*V-1	
C	.005							PT625		
C58	.0047	600	T16-230	1484-005		IR5D47		MCB465	MS-25	
C59	.0047	600	T16-220	P688-0047	D6-472	CUB6D47	GP2-333-472	PT6247	6TM-D47	
C60	.47	600	T16-249	584-47		CUB6P47		PT605	6TM-P47	
C61	.01	400	T16-247	P488-01	D6-103	CUB681	GP2-333-103	PT611	5TM-81	
C62	.022	400	T16-248	P488-022	DF-203	CUB4822	817-03	PT4123	4TM-S22	
C63	.1	400	T16-244	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C64	.047	400	T16-245	P488-047	DF-503	CUB4847		PT4147	4TM-847	
C65	.01	400	T16-247	P488-01	D6-103	CUB681	GP2-333-103	PT411	4TM-81	
C66	.0047	600	T16-220	P688-0047	D6-472	CUB6D47	GP2-333-472	PT6247	5TM-D47	
C67	1000		T15-220	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C68	1000		T15-220	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C69	.01	600	T16-237	P688-01	D6-103	CUB681	GP2-333-103	PT611	6TM-81	
C70	.0047	600	T16-220	P688-0047	D6-472	CUB6D47	GP2-333-472	PT6247	6TM-D47	
C71	.047	400	T16-245	P488-047	DF-503	CUB4847		PT4147	4TM-847	
C72	3900	500		1484-004		IR5D39		MCB463	MS-24	
C73	330	500	T15-226	1489-00035		5R5T33				Note 3
C74	330	500	T15-226	1489-00035		5R5T33				
C75	.01	400	T16-247	P488-01	D6-103	CUB681	GP2-333-103	PT611	4TM-81	
C76	.1	400	T16-244	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C77	.047	400	T16-245	P488-047		CUB4847		PT4147	4TM-847	
C78	.047	400	T16-245	P488-047		CUB4847		PT4147	4TM-847	
C79	500	20000	T15-239	HV20C	TV3-502	MMU20T6	413	HV20035A	20DK-T5	
C80	56	2000			DD30-560		3KV-560		20GA-Q56	
C81	.01	600	T16-237	689ZX-01		CUB681		PT611	6TM-81	
C82	.01	600	T16-237	689ZX-01		CUB681		PT611	6TM-81	
C83	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	Note 1
C84	5000		T16-177	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	Note 1
C85	.047	400	T16-245	P488-047	DF-503	CUB4847		PT4147	4TM-847	Note 1
C86	.22	200	T16-253	P288-22		CUB2P22		PT4022	2TM-P22	Note 1

Note 1. Not used in all models.
Note 2. Ch. 528.299, 528.299-1, 528.299-2 use .01MFD in this application.
Note 3. Some models use 270MMF in this application.
Note 4. Some models may use 150MMF in this application.
♦ Items C57A, C57B, C57C, R67A, R67B, R67C are combined in one unit.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	Silvertone Part No.	IRC Part No.	CLAROSTAT Part No.	CENTRALAB Part No.	MALLORY Part No.	INSTALLATION NOTES
R1A	1000Ω	½	24-206	*QJ-482	RTV-282		UF13L	Contrast Panel - Note 3
B	500KΩ	½					UR55A	Volume-Rear
C	Switch						U8-26	Attach to R1B
R2A	2 Meg	½	A25-27	Q11-138	A47-2Meg-S	AB-75	U-56	Vert. Hold
B	Shaft		Not Req.	Not Req.	KS8-3	AK-4	Not Req.	Attach to R2A
R3A	4.7Meg with 1Meg stop	½	A25-35	Q11-141	A47-5Meg-S	AB-87	U-67	Height-Note 1
B	Shaft		Not Req.	RQ	FKS-1/4	AK-1	Not Req.	Attach to R3A
R4A	50KΩ	½	A25-21	Q11-123	A47-50K-S	AB-31	U-35	Horiz. Hold
B	Shaft		Not Req.	Not Req.	KS8-3	AK-4	Not Req.	Attach to R4A
R5A	100KΩ	½	A25-26	Q11-128	A47-100K-S	AB-40	U-41	Brightness
B	Shaft		Not Req.	Not Req.	KS8-3	AK-4	Not Req.	Attach to R5A
R6A	2500Ω	½	A25-13	Q11-112	A47-3000-S	AB-7	U-8	Vert. Linearity
B	Shaft		Not Req.	RQ	FKS-1/4	AK-1	Not Req.	Attach to R6A
R7	500KΩ	½	T24-307					Tone & phono switch-Note 2

Note 1. Connect a 1 Meg resistor in series with the left hand terminal of the control and the lead connecting to the same terminal of the original control (control viewed from shaft end, terminals down).
Note 2. Not used in all models.
Note 3. Some models may use an alternate control Part No. T24-313.
* CONCENTRIKIT EQUIVALENT KIT K-2 BASE ELEMENTS & SHAFTS B17-108 & P1-200 (Panel) B13-133 & R1-223 (Rear) & SWITCH 78-1.

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	Silvertone Part No.	IRC Part No.	NOTES
R8	15KΩ	½		BTS-15K	
R9	47KΩ	½		BTS-47K	
R10	100KΩ	½		BTS-100K	
R11	160KΩ	½		BTS-160K	
R12	100KΩ	½		BTS-100K	
R13	1500Ω	½		BTS-1500	
R14	10KΩ	½		BTS-10K	
R15	220KΩ	½		BTS-220K	
R16	10KΩ	½		BTS-10K	
R17	15KΩ	½		BTS-15K	
R18	1000Ω	½	T60-703	BTS-1000	
R19	1000Ω	½	T60-703	BTS-1000	
R20	3300Ω	½	T60-883	BTS-3300	
R21	1000Ω	½	T60-703	BTS-1000	
R22	47Ω	½	T60-798	BTS-47	
R23	22KΩ	½	T60-744	BTS-22K	
R24	330Ω	½	T60-704	BTS-330	
R25	1000Ω	½	T60-703	BTS-1000	
R26	47Ω	½	T60-798	BTS-47	
R27	12KΩ	½	T60-811	BTS-12K	
R28	330Ω	½	T60-704	BTS-330	
R29	150Ω	½	T60-757	BTS-150	
R30	330Ω	½	T60-704	BTS-330	
R31	12KΩ	½	T60-811	BTS-12K	
R32	3300Ω	½	T60-883	BTS-3300	Note 4
R33	390Ω	½	T60-685	BTS-390	Note 1
R34	10KΩ	½	T60-780	BTS-10K	
R35	2700Ω	2	T60-914		
R36	2200Ω	2	T60-905		
R37	150KΩ	½	T60-918	BTS-150K	
R38	47KΩ	½	T60-903	BTS-47K	

ITEM No.	RATING OHMS	RATING WATT	Silvertone Part No.	IRC Part No.	NOTES
R39	33KΩ	½	T60-748	BTS-33K	
R40	180KΩ	½	T60-788	BTS-180K	
R41	10KΩ	½	T60-780	BTS-10K	
R42	47KΩ	½	T60-903	BTS-47K	
R43	470KΩ	½	T60-902	BTS-470K	
R44	220KΩ	½	T60-672	BTS-220K	
R45	33KΩ	½	T60-748	BTS-33K	
R46	560Ω	½	T60-758	BTS-560	
R47	10KΩ	1	T60-598	BTA-10K	
R48	220Ω	½	T60-753	BTS-220	
R49	47KΩ	½	T60-903	BTS-47K	
R50	12KΩ	½	T60-811	BTS-12K	
R51	4.7Meg	½	T60-904	BTS-4.7Meg	
R52	270KΩ	½	T60-747	BTS-270K	
R53	2.2Meg	½	T60-898	BTS-2.2Meg	
R54	100Ω	½	T60-752	BTS-100	
R55	100KΩ	½	T60-801	BTS-100K	
R56	470KΩ	½	T60-902	BTS-470K	
R57	470KΩ	½	T60-902	BTS-470K	
R58	3300Ω	1	T60-724	BTA-3300	
R59	220Ω	2	T60-928	BTB-220	
R60	15KΩ	½	T60-783	BTS-15K	
R61	270KΩ	½	T60-747	BTS-270K	
R62	1.5Meg	½	T60-880	BTS-1.5Meg	
R63	2200Ω	½	T60-714	BTS-2200	
R64	680KΩ	½	T60-807	BTS-680K	
R65	3900Ω	½	T60-710	BTS-3900	
R66	3300Ω	½	T60-883	BTS-3300	
R67A	22KΩ	½	♦ T17-109	BTS-22K	
B	8200Ω	½		BTS-8200	
C	8200Ω	½		BTS-8200	

RESISTORS (cont)

ITEM No.	RATING OHMS	RATING WATT	Silvertone Part No.	IRC Part No.	NOTES
R68	1.5Meg	½		BTS-1.5Meg	Note 6
R69	3.3Meg	½	T60-922	BTS-3.3Meg	
R70	10KΩ	½	T60-780	BTS-10K	
R71	2.2Meg	½	T60-898	BTS-2.2Meg	
R72	470Ω	1	T60-694	BTA-470	
R73	470Ω	1	T60-694	BTA-470	
R74	560Ω	½		BTS-560	
R75	560Ω	½	T60-801	BTS-560	
R76	15KΩ	2	T60-901	BTB-15K	
R77	100KΩ	½	T60-801	BTS-100K	
R78	100KΩ	½	T60-801	BTS-100K	
R79	4.7Meg	½	T60-904	BTS-4.7Meg	
R80	470KΩ	½	T60-902	BTS-470K	
R81	1500Ω	½	T60-729	BTS-1500	
R82	8200Ω	½	T60-778	BTS-8200	
R83	120KΩ	½	T60-817	BTS-120K	

Note 1. Not used in all models.
Note 2. Used in chassis 528.299-2 , 528.290-2, & 528.302 only.
Note 3. Used in chassis 528.291, 528.290, 528.297, 528.299 only.
Note 4. Some models may use a 4700Ω resistor in this application.
Note 5. Some models may use a 5000Ω resistor in this application .
Note 6. Some models may use a 1.8 Meg resistor in this application.
♦ Items R67A, R67B, R67C, C57A, C57B, C57C are combined in one unit.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	RATING SEC. 3	RATING SEC. 4	RATING SEC. 5	Silvertone Part No.	Stancor Part No.	Merit Part No.	Triad Part No.	RCA TYPE No.	Halldorson Part No.	Thordarson Part No.
T1	117VAC @ 1.6A	564VCT .220ADC	5VAC @ 3A				80-294	P-8332 ①		R-81BC			
				6.3VAC @ 1.43A	6.3VAC @ 8.9A								

① Parallel and phase 6.3V-9A.and 6.3V-7A for Sec. 4.
② Parallel and phase 6.3V-6A.windings for Sec. 4.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No.	USE	Silvertone Part No.	Stancor Part No.	Merit Part No.	Triad Part No.	RCA TYPE No.	Halldorson Part No.	Thordarson Part No.
T2	Vert. Osc. Trans.	T60-288	A-8125 ①	A-3003 ①	A-97X①	209T1 ①	S6702 ①	24A87 ①
T3	Horiz. Output Trans.	T60-293		HV0-9 & MWC-1 * ②	D-19 & WC-11 * ②	232T1 & 212R1 *	FS41i & RF800 * ②	
T4	Vert. Output Trans.	T60-290	A-8142 ②③	A-3038 ①③	A-198X ①③	210X2 ①③	25853 ①③	
T5A	Yoke-Horiz. (14MH)	T83-776 ⑪	DY-9A	MDF-72	Y-17-1	21ID2	DF302	Y-7
B	Vert. (43MH)							
T6	Horiz.Lin.Coil(1.5-8.6MH)	T10-562	WC-8	MWC-8 ④	WC-12 ⑦	213R1	RF800 ④ ⑤	WC-17 ③
		T10-604 ④	WC-8 ⑤	MWC-8 ⑤	WC-12 ⑤⑦	213R1 ⑤	RF800 ⑤ ⑧	WC-17 ⑤ ⑧
T7	Width Coil (.05-.3MH)	T10-551	WC-1			201R1		WC-10 / WC-11
		T10-602 ⑰	WC-1 ⑤			201R1 ⑤		WC-10 / WC-11 ⑤

① Drill one new mounting hole.
② Drill new mounting holes.
③ Connect as auto transformer.
④ Alternate horizontal linearity coil used in Ch. 528.291, 528.297.
⑤ Drill new mounting hole, or use original slider and core.
⑥ Enlarge mounting hole.
⑦ Connect to coded blue and green terminals.
⑧ Connect to terminals #3 and #4.
⑩ Do not use tap.
⑪ Alternate width coil, used in Ch. 528.291, 528.297
⑫ Includes capacitor C80, resistors R74, R75 and R95.

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

ORIGINAL TERMINAL CONNECTIONS	Stancor Replacement Connections	Merit Replacement Connections	Triad Replacement Connections	RCA Replacement Connections	Halldorson Replacement Connections	Thordarson Replacement Connections
Horiz.Output Plate Lead		9	9	10	9	
5(NC)		NC	NC	NC See Note ⑰	NC See Note ⑰	
4		7	7 & 8			
3		T	T	4	T	
2		3	3	3	T	
1		1	1	3	3	
A		MWC-1 (Blue term)	WC-11 (Blue term)	2	RF800 (Term #1)	
G		MWC-1 (Red term)	WC-11 (Red term)	1	RF800 (Term #2	
Connect Width Coil Across →	2 & 1	MWC-1 (orange & black terms) 3 & 1	WC-11 (orange & black terms) 3 & 1	212R1 2 & 1	RF800 (Term #3 & #4) T & 3	
Special Notes →		⑫ ⑬	⑬	⑭	⑫ ⑬ ⑮	

⑫ If insufficient width, connect a .004MMF, 800V capacitor across terminals "T" and #3.
⑬ If the picture is out of phase, reverse primary, or secondary connections of width coil.
⑭ Connect yellow lead (damper cathode) to terminal #9, red lead (yoke) to terminal #7.
⑮ Connect yellow lead (damper cathode) to terminal #8, red lead (yoke) to terminal #7.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	Silvertone Part No.	Stancor Part No.	Merit Part No.	Triad Part No.	Halldorson Part No.	Thordarson Part No.	NOTES
T8	2.1KΩ	3.1Ω	80-291	A-3849	A-2928	S-4X	Z1110	22345	

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V. C. IMP.	Silvertone Part No.	VIKING Part No.	QUAM Part No.	NOTES
SP1	5"	PM	3.1Ω	T79-397 ①	5J4	5A07	① Used in models 3103A, 4107, 4107A, 4110, 4114C, 4115A, 4114A, 4114B, 4114C, 5111.
	8"	PM	3.1Ω	T79-396 ②	6J4	8A1	② Used in models 4124, 4126D, and 4126B
	8"	PM	3.1Ω	T79-398 ③	8J9	8A21	③ Used in models 4128B, 4126A, 4128A, and 4132.
	10"	PM	3.1Ω	T79-408 ④	10J11	10A31	④ Used in model 4139A, 4142, 4144, 4149E

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	Silvertone Part No.	MEISSNER Part No.	MERIT Part No.	MILLER Part No.	NOTES
L1	Ant. Coils	00CT	0Ω					
L2	Fil. Choke	0Ω						
L3	Neutr. Coil	0Ω						
L4	RF, Mixer Grid & Osc. Coils	0Ω						
L5	Fil. Choke	0Ω						
L6	RF Choke	0Ω						
L7	1st Video IF	.9Ω						
L8	RF Choke	1.1Ω						
L9	2nd Video IF	.3Ω	.3Ω	T10-541	17-1062		6250	
L10	3rd Video IF	.3Ω	.3Ω	T10-542	17-1063		6249	
L11	4th Video IF	.5Ω	.5Ω	T10-588 ■				Includes 21.75MC Trap
L12	Series Peak Coil	4Ω		T33-237	19-6022		6152	20 Microhenries
L13	Series Peak. Coil	9Ω		T10-607	19-4120		6153 ▲	120 Microhenries; wound on 10KΩ resistor
L14	Shunt Peak. Coil	13Ω		T10-609	19-3250	TV-185	6154	220 Microhenries
L15	Series Peak. Coil	10.5Ω		T10-591	19-3180 ▲	TV-184 ▲	6644 ▲	150 Microhenries; wound on a 10KΩ resistor
L16	4.5MC Trap	3.1Ω		T10-581	20-1004	TV-151	1469	
L17	Shunt Peak. Coil	11Ω		T10-590 *	19-3250	TV-185	6181	269 Microhenries;
L18	Sound IF	3.2Ω		T10-587	20-1005	TV-151	1469	
L19	Ratio Det.	3.8Ω	.30CT	T10-583	17-1033 ▲	TV-110 ▲	1468 ▲	Tertiary winding .8Ω
L20	Horiz. Osc. Coil	53Ω		T10-583	19-1576	TV-163	6210	

* Chassis 528.290 uses 193Microhenries coil wound on 6.2KΩ resistor in this application.
Part No. T10-612 , Missner 19-4200, Merit TV-184 †, Miller 6154 †
■ Alternate Part No. T10-617 in chassis 528.299-2, 528.302, 528.290-2, 528.291-2.
† Parallel with a 820ΩΩ resistor.
▲ Parallel with a 10KΩ resistor.
▲ Drill mounting holes and disconnect capacitor across primary winding.

FILTER CHOKE

ITEM No.	RATINGS TOTAL DIRECT CURRENT	RATINGS D.C. RESISTANCE	RATINGS INDUCTANCE CURRENT 1000 ~	Silvertone Part No.	Stancor Part No.	Merit Part No.	Triad Part No.	Halldorson Part No.	Thordarson Part No.
L21	220A	85Ω	1.2HY	33-238	C-2327	C-29X 1	C-21X 1	C5037 1	26C44 1

① Drill one new mounting hole.

FUSES

ITEM No.	TYPE	RATING	Silvertone Part No. FUSE	Silvertone Part No. HOLDER	LITTELFUSE Part No. FUSE	LITTELFUSE Part No. HOLDER	BUSS Part No. FUSE	BUSS Part No. HOLDER
M1	3AG	1A 250V	T43-15	T87-44	312001	341001	AGC1	HKP

MISCELLANEOUS

ITEM No.	PART NAME	Silvertone Part No.	NOTES
M2	Tuner	T95-37	VHF, all chassis
M3	Focus Magnet	T10-611 *	Includes centering device, Ch. 528.290-1, 528.291-2, 528.291-1, 528.291, 528.290, 528.297, 528.299-2, 528-291-2, 528.291-1, 528.291, 528.290, 528.297, 528.290-2, 528.303, 528.299-1, 528.299, 528.299-2
M4	Ion Trap	T83-684	All chassis
	Cabinet	T42-616	Ch. 528.290-1 - Model 4107
	Cabinet	T42-644	Ch. 528.290-1 and 528.290-2 - Model 4107A
	Cabinet	T42-641	Ch. 528.290,-1, -2 - Model 4124
	Cabinet	T42-652	Ch. 528.290-2, Model 3103A
	Cabinet	T42-580	Ch. 528.299, -1, -2 Model 4139A
	Cabinet	T42-649	Ch. 528.302 Model 4110
	Cabinet	T42-646	Ch. 528.302 Model 4114C & Ch. 528.291-1 Model 4114B
	Cabinet	T42-650	Ch. 528.302 Model 4126D
	Cabinet	T42-656	Ch. 528.302 Model 4128B
	Cabinet	T42-643	Ch. 528.291-2 Model 4132
	Cabinet	T42-630	Ch. 528.291-1 Model 4118A
	Cabinet	T42-625	Ch. 528.291-1 Model 4126B
	Cabinet	T42-621	Ch. 528.291 Model 4128A
	Cabinet	T42-623	Ch. 528.297 Model 4126A
	Cabinet	T42-667	Ch. 528.302 Model 5111

SILVERTONE MODELS 3103A, 4107, A, 4110, 4111A, 4114A, B, C, 4124, 4126A, B, D, 4128A, B, 4132, 4139, 4142, 4144, 4149E (Ch. 528.290, -1, -2, 528.291, -1, -2, 528.297, 528.299, -1, -2, 528.302)

PARTS LIST AND DESCRIPTIONS (Continued)

MISCELLANEOUS (cont)

ITEM No.	PART NAME	Silvertone PART No.	NOTES
	Cabinet	T42-586	Ch. 528.299-2 Model 4142
	Cabinet	T42-582	Ch. 528.299-2 Model 4144
	Cabinet	T42-581	Ch. 528.299-2 Model 4149E
	Knob	T52-429	Channel Selector Ch. 528.291 Models 4111A 4114A, 4128A Ch. 528.291-1 Models 4111A, 4114B, 4126B, Ch. 528.302 Models 4110, 4126D, 4128B, 5111, Ch. 528.290-2 Models 3103A, 4107A, 4124, Ch. 528.290-1 Models 4107, 4107A, 4124, Ch. 528.290 Model 4124
	Knob	T52-462	Channel Selector Ch. 528.299-2 Model 4142
	Knob	T52-428	Channel Selector Ch. 528.302 Model 4114C Ch. 528.291-2 Models 4114B, 4132 Ch. 528.299-1 Model 4139A Ch. 528.299 Model 4139A Ch. 528.299-2 Models 4139A, 4144, 4149E
	Knob	T52-399	Channel Selector Ch. 528.297 Model 4126A
	Knob	T52-433	Fine tuning Ch. 528.291-2 Models 4114B, 4132, Ch. 528.299-1 Models 4139A, Ch. 528.299 Model 4139A, Ch. 528.299-2 Mod- els 4139A, 4144, 4149E, Ch. 528.291 Models 4111A, 4114A, 4128A, Ch. 528.291-1 Models 4111A, 4114B, Ch. 528.302 Models 4110, 4114C, 4128B, Ch. 528.290-2 Models 3103A, 4107A, Ch. 528.290-1 Models 4107, 4107A
	Safety Glass	T48-67	Ch. 528.297 Model 4126A Ch. 528.291-1 Models 4111A, 4114B, 4126B Ch. 528.302 Model 4114C Ch. 528.291-2 Models 4114B, 4132 Ch. 528.291 Models 4111A, 4114A, 4128A
	Safety Glass	T48-79	Ch. 528.302 Models 4110, 4126D, 4128B, 5111
	Safety Glass	T48-75	Ch. 528.299-1 Model 4139A Ch. 528.299 Model 4139A Ch. 528.299-2 Models4139A, 4142, 4144, 4149E
	Safety Glass	R48-78	Ch. 528.290-2 Models 3103A, 4107A, 4124 Ch. 528.290-1 Models 4107A, 4124 Ch. 528.290 Model 4124
	Safety Glass	T48-73	Ch. 528.290-1 Model 4107
	Mask	T31-242	Ch. 528.291 Models 4111A, 4114A, 4128A Ch. 528.297 Model 4126A Ch. 528.291-1 Models 4111A, 4114B, 4126B Ch. 528.291-2 Models 4114B, 4132
	Mask	T31-252	Ch. 528.291-2 Models 4114B, 4132
	Mask	T31-248	Ch. 528.302 Models 4110, 4126D, 4128B, 5111
	Mask	T31-251	Ch. 528.302 Model 4114C
	Mask	T31-236	Ch. 528.290-1 Model 4107
	Mask	T31-245	Ch. 528.290-2 Models 3103A, 4107A, 4124 Ch. 528.290-1 Models 4107A, 4124 Ch. 528.290 Model 4124
	Mask	T31-237	Ch. 528.299-1 Model 4139A Ch. 528.299 Model 4139A Ch. 528.299-2 Models 4139A, 4149E
	Mask	T31-255	Ch. 528.299-2 Models 4142, 4144
	Knob	T52-396	Fine tuning - Ch. 528.297 Model 4126A
	Knob	T52-432	Fine tuning - Ch. 528.291-1 Model 4126B Ch. 528.302 Model 4126D Ch. 528.290-2 Model 4124 Ch. 528.290-1 Model 4124 Ch. 528.290 Model 4124 Ch. 528.299-2 Model 4142
	Knob	T52-412	Fine tuning - Ch. 528.302 Model 5111
	Knob	T52-417	Contrast Ch. 528.291-1 Models 4111A, 4114B Ch. 528.302 Models 4110, 4114C, 4128B Ch. 528.290-2 Models 3103A, 4107A Ch. 528.290-1 Models 4107, 4107A Ch. 528.299-2 Models 4139A, 4144, 4149E Ch. 528.299 Model 4139A Ch. 528.299-1 Model 4139A Ch. 528.291-2 Models 4114B, 4132 Ch. 528.291 Models 4111A, 4114A, 4128A
	Knob	T52-404	Contrast - Ch. 528.291-1 Model 4126B Ch. 528.290-2 Model 4124 Ch. 528.290-1 Model 4124 Ch. 528.302 Model 4126D, 5111 Ch. 528.290 Model 4124 Ch. 528.299-2 Model 4142
	Knob	T52-397	Contrast - Ch. 528.297 Model 41126A
	Knob	T52-418	Volume - Off/on Ch. 528.291-1 Models 4111A, 4114B, 4126B Ch. 528.290-2 Mocels 3103A, 4107A, 4124 Ch. 528.290-1 Models 4107, 4107A, 4124 Ch. 528.302 Models 4110, 4126D, 4128B, 5111 Ch. 528.291 Models 4111A, 4114A, 4128A Ch. 528.290 Model 4124
	Knob	T52-405	Volume-On/off Ch. 528.299-2 Models 4139A, 4144, 4149E Ch. 528.299 Model 4139A Ch. 528.299-1 Model 4139A Ch. 528.291-2 Models 4114B, 4132 Ch. 528.302 Model 4114C
	Knob	T52-401	Volume On/off Ch. 528.297 Model 4126A
	Knob	T52-421	Volume On/off Ch. 528.299-2 Model 4142

* Alternate part #T10-652, Chassis 528.299-2, 528.302, 528.290-2, 528.291-2.

TROUBLE SHOOTING AIDS (cont)

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST.
DENVER, COLORADO

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V16, V17, V18 and V19. Check waveform W16.

If Satisfactory	If Unsatisfactory
Check T3, T5A, T6, T7, C78, C77, C76, R91, R90 and other associated components.	Check L20, C72, C73, C75, R82, R84, R81 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V16, V17, V18 and V20. Check R91. Check B2 and B3 and other associated components.

BLOOMING

Check by substitution V17, V18, V19 and V20. Check R91. Check B+ filter and decoupling network.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or No Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5, V6 and V7. Check video IF components.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

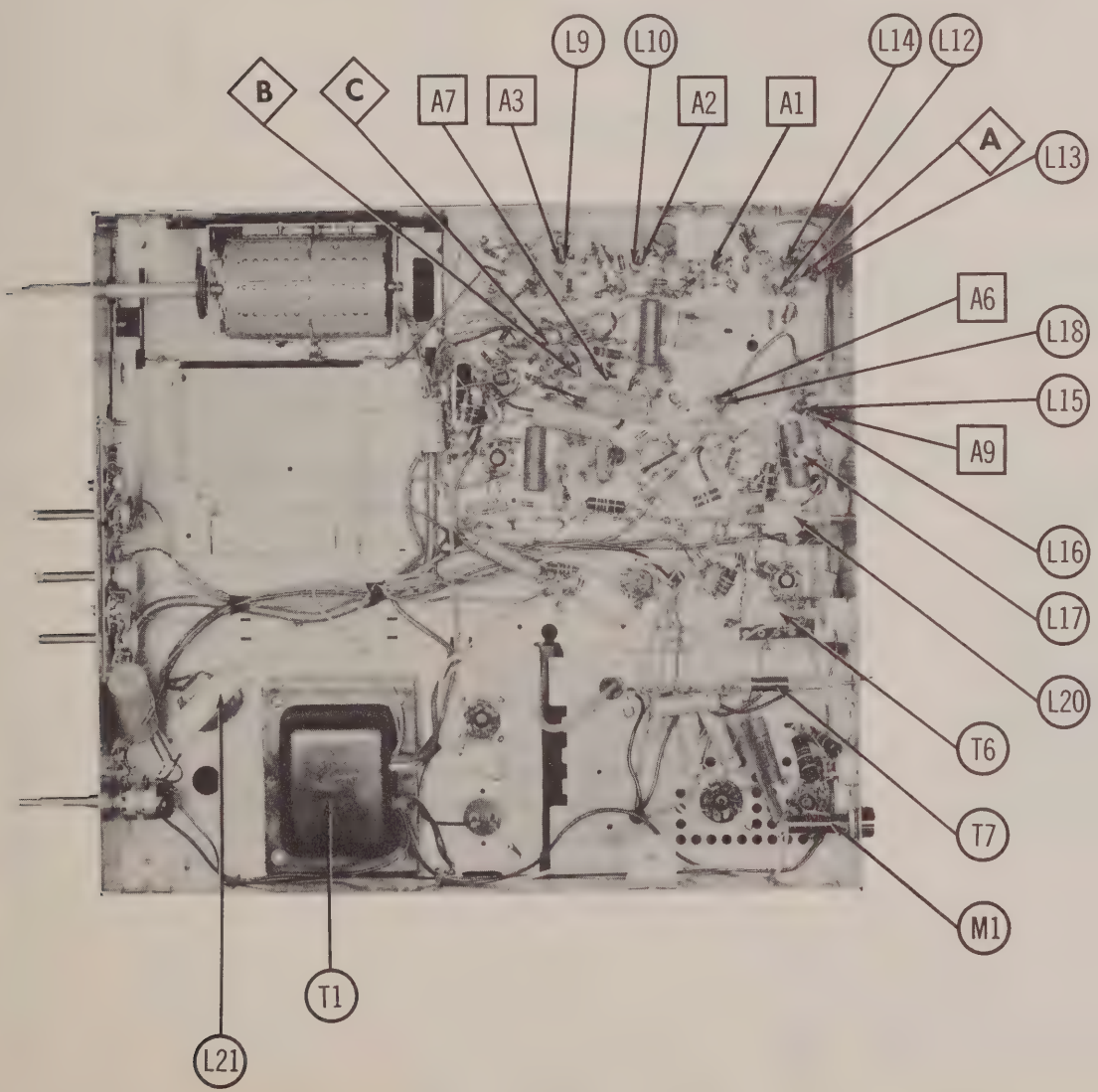
KEYSTONE EFFECT

Check T5 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR & ALIGN. IDENTIFICATION

SILVERTONE MODELS 3103A, 4107, A, 4110, 4111A, 4114A, B, C, 4124, 4126A, B, D, 4128A, B, 4132, 4139, 4142, 4144, 4149E (Ch. 528.290, -1, -2, 528.291, -1, -2, 528.297, 528.299, -1, -2, 528.302)

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustments of the VHF tuner oscillator circuit may be accomplished by removal of the channel selector and fine tuning knobs. The adjustments are accessible, one at time, thru the small hole in the cabinet to the right of the channel selector shaft.

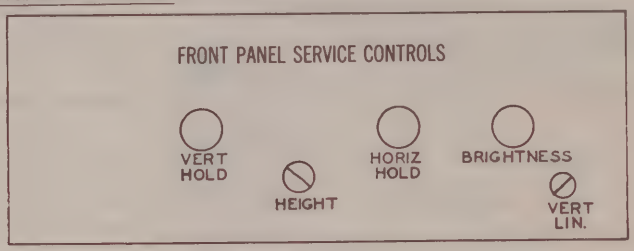
PICTURE TUBE SAFETY GLASS CLEANING

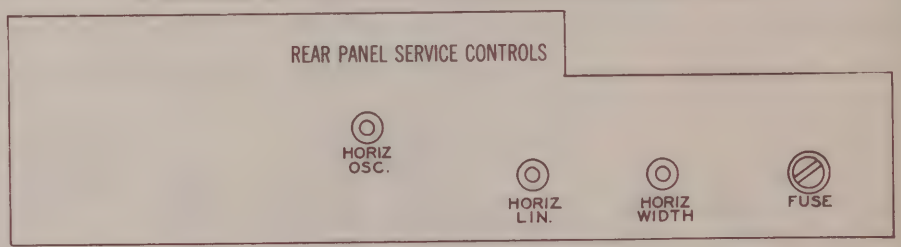
For picture tube safety glass cleaning, it is necessary to remove chassis. (See disassembly instructions).

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions).

SERVICE ADJUSTMENT LOCATION





HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

Adjustment of the horizontal oscillator circuit can be made from the rear panel of the chassis. Set the horizontal hold control at the mid-position of its range and adjust the horizontal oscillator slug (L20) until the picture synchronizes horizontally.

SOUND IF DETECTOR BUZZ ADJUSTMENT

To eliminate sound IF detector, adjust the ratio detector secondary (L19) located on top of chassis. (See tube placement chart).

FUSES

One fuse is used for LV power supply protection. (For location see tube placement chart).

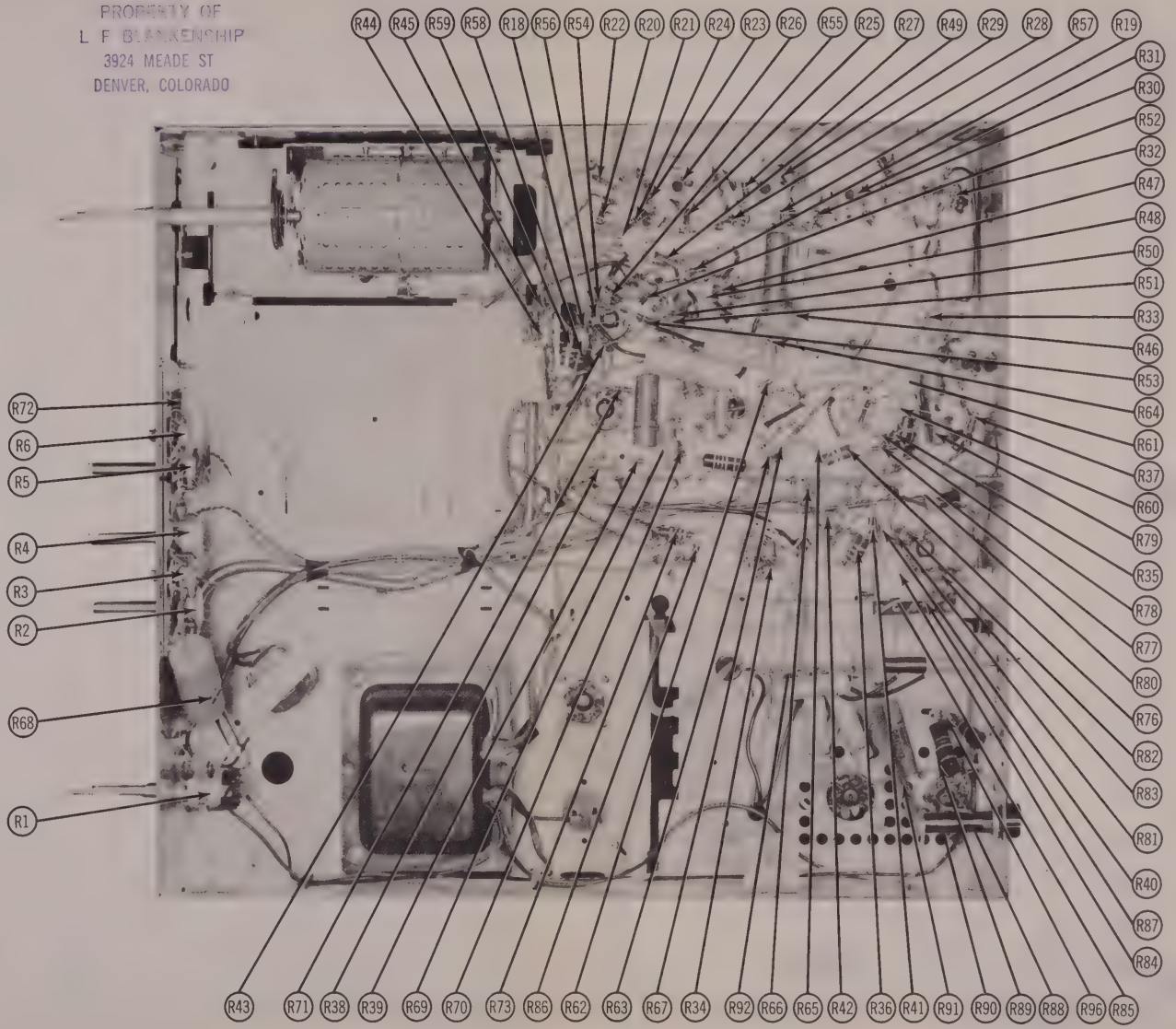
CENTERING

Centering is accomplished mechanically by means of a centering lever on the PM focusing assembly. Adjust the centering lever from side to side, and up and down until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

1. Remove 4 push-on type control knobs from front panel.
2. Remove 7 wood screws and 1 metal screw. Remove rear cover.
3. Remove 2 wood screws from antenna bracket. Remove bracket.
4. Disconnect speaker. Remove 2 speaker nuts. Remove speaker.
5. Remove 4 chassis bolts. Remove chassis.

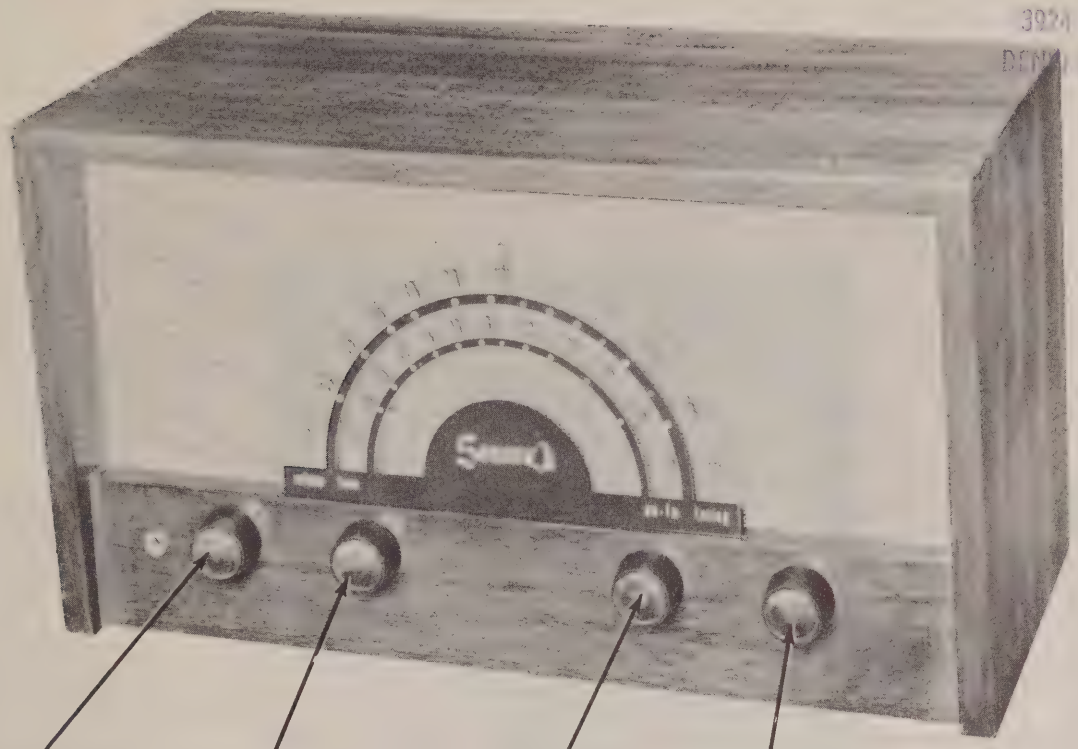
PROPERTY OF
L F BLANKENSHIP
3924 MEADE ST
DENVER, COLORADO



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PROPERTY OF
L. F. BLANKENSHIP
3924 MAPLE ST
BENTON, ILLINOIS

SONORA
MODELS 458, 459



SONORA
MODELS 458, 459

TRADE NAME	Sonora Models 458, 459
MANUFACTURER	Sonora Radio & Tel. Corp., 325 N. Hoyne Ave., Chicago, Ill.
TYPE SET	AC-DC operated AM-FM Superheterodyne Receiver
TUBES (Six)	Types 12BA6 RF Amp., 12BE6 FM Conv.-AM Osc., 12AU6 AM Mixer-FM IF Amp., 12BA6 FM-AM IF Amp., 19T8 Ratio Det-AM Det-AF Amp., 50C5 Audio Amp.
POWER SUPPLY	110-120 Volts AC-DC — RATING .31 Amp. @ 117 Volts AC
TUNING RANGE— BROADCAST	535-1620KC — FREQ. MOD. 87-109MC

HOWARD W. SAMS & CO., INC. • Indianapolis 5, Indiana

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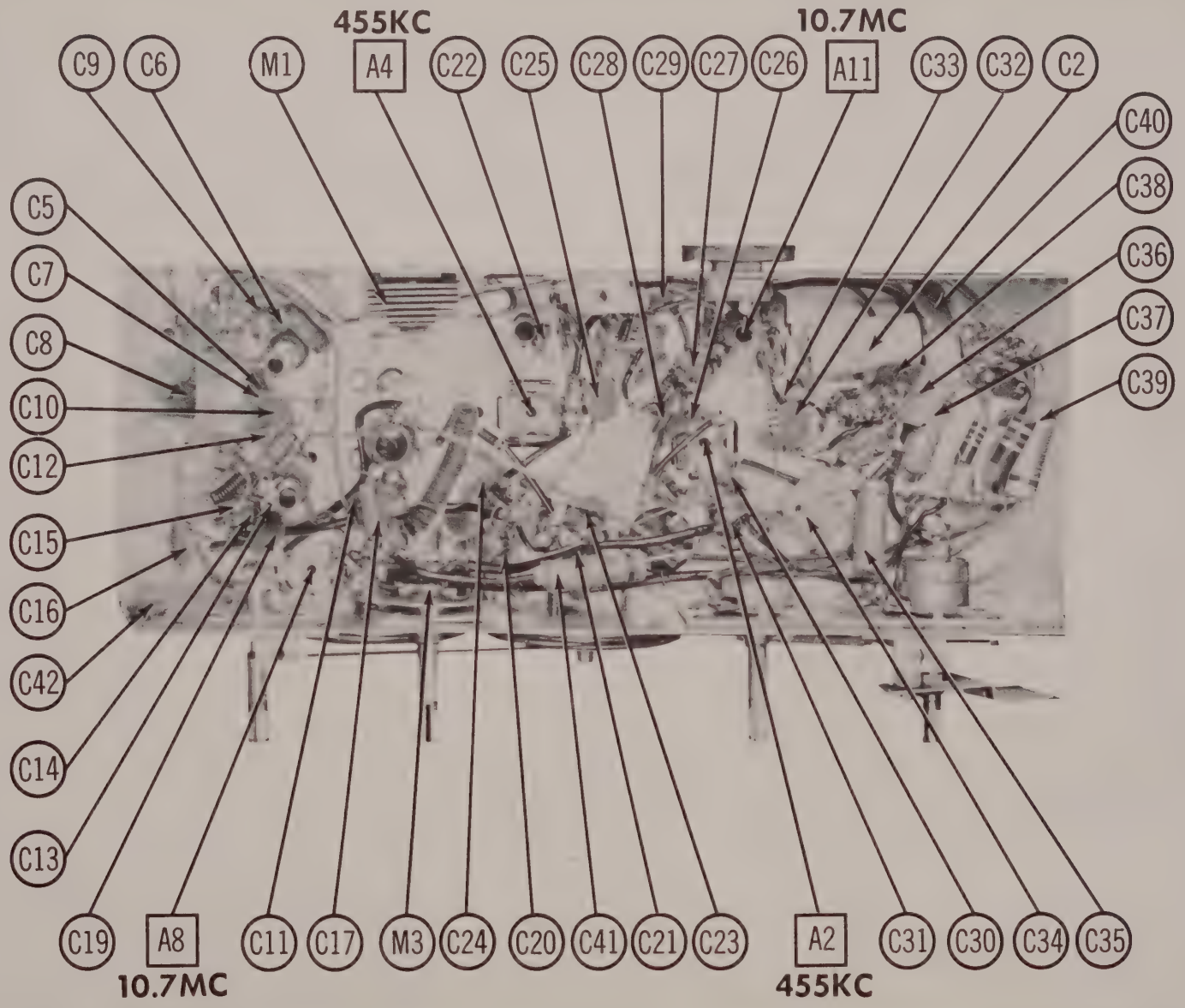
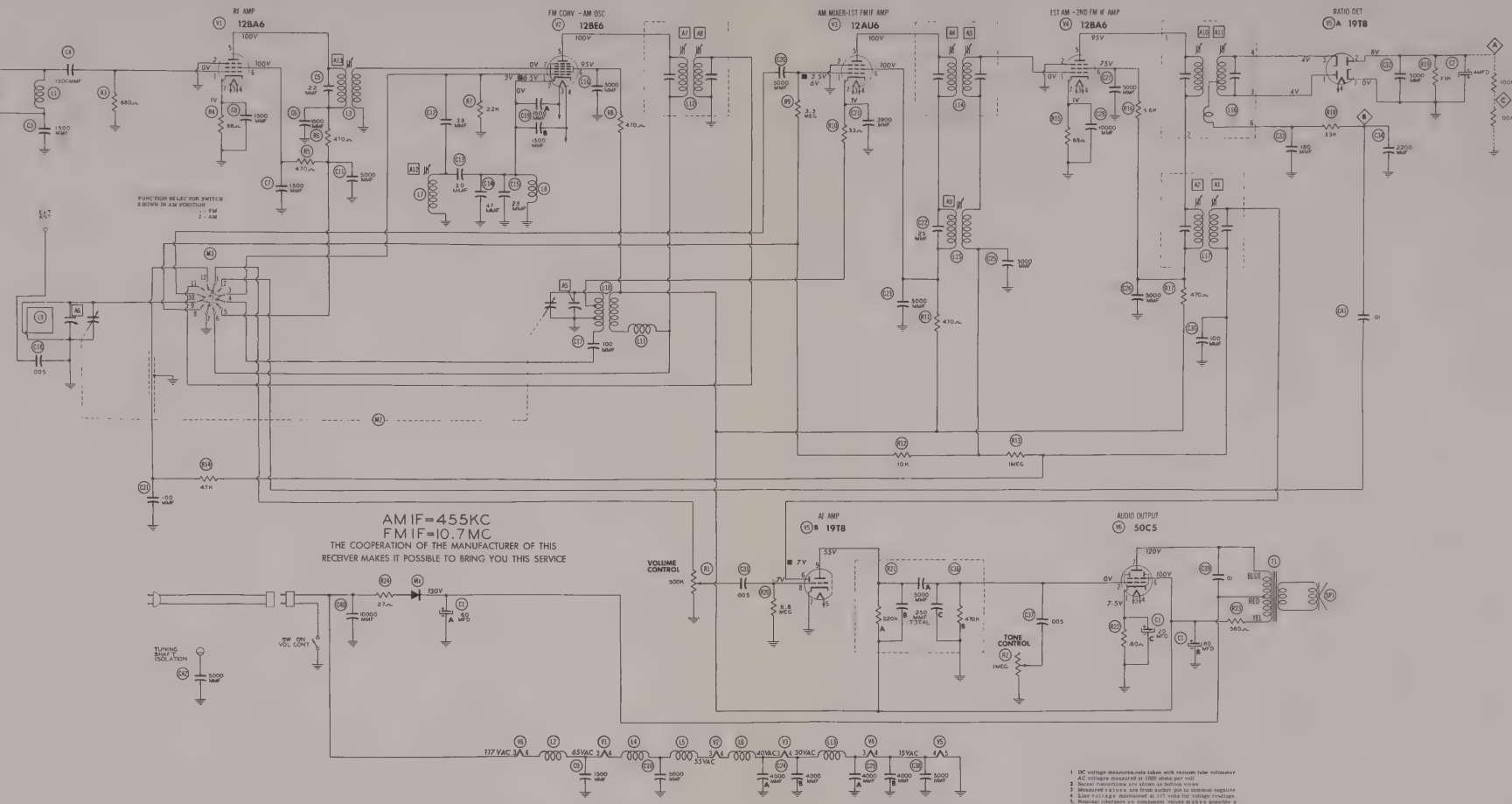


CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12BA6	680Ω	0Ω	78Ω	66Ω	† 1KΩ	† 1KΩ	68Ω		
V 2	12BE6	* 22KΩ	0Ω	60Ω	48Ω	† 570Ω	† 1KΩ	0Ω		
V 3	12AU6	* 4.8Meg 3.3Meg	0Ω	46Ω	33Ω	† 1KΩ	† 1KΩ	33Ω		
V 4	12BA6	* 1.5Meg 10KΩ	0Ω	30Ω	18Ω	† 1KΩ	† 6.5KΩ	68Ω		
V 5	19T8	INF	33KΩ	INF	18Ω	0Ω	* 550KΩ	0Ω	6.8Meg	† 220KΩ
V 6	50C5	180Ω	470K	134Ω	81Ω	470KΩ	† 565Ω	† 150Ω		

ALL READINGS IN FM POSITION UNLESS OTHERWISE DESIGNATED
* MEASURED IN AM POSITION.
† MEASURED FROM OUTPUT OF M1

1 DC voltage measurements taken with vacuum tube voltmeter
AC voltages measured at 1000 ohms per volt
2 Socket connections are shown as bottom views
3 Measured values are from socket pin to common negative
4 Line voltage maintained at 117 volts for voltage readings
5 Minimal tolerance on component values makes possible a variation of ± 10% in voltage and resistance readings
6 Volume control at maximum, no signal applied for voltage measurements

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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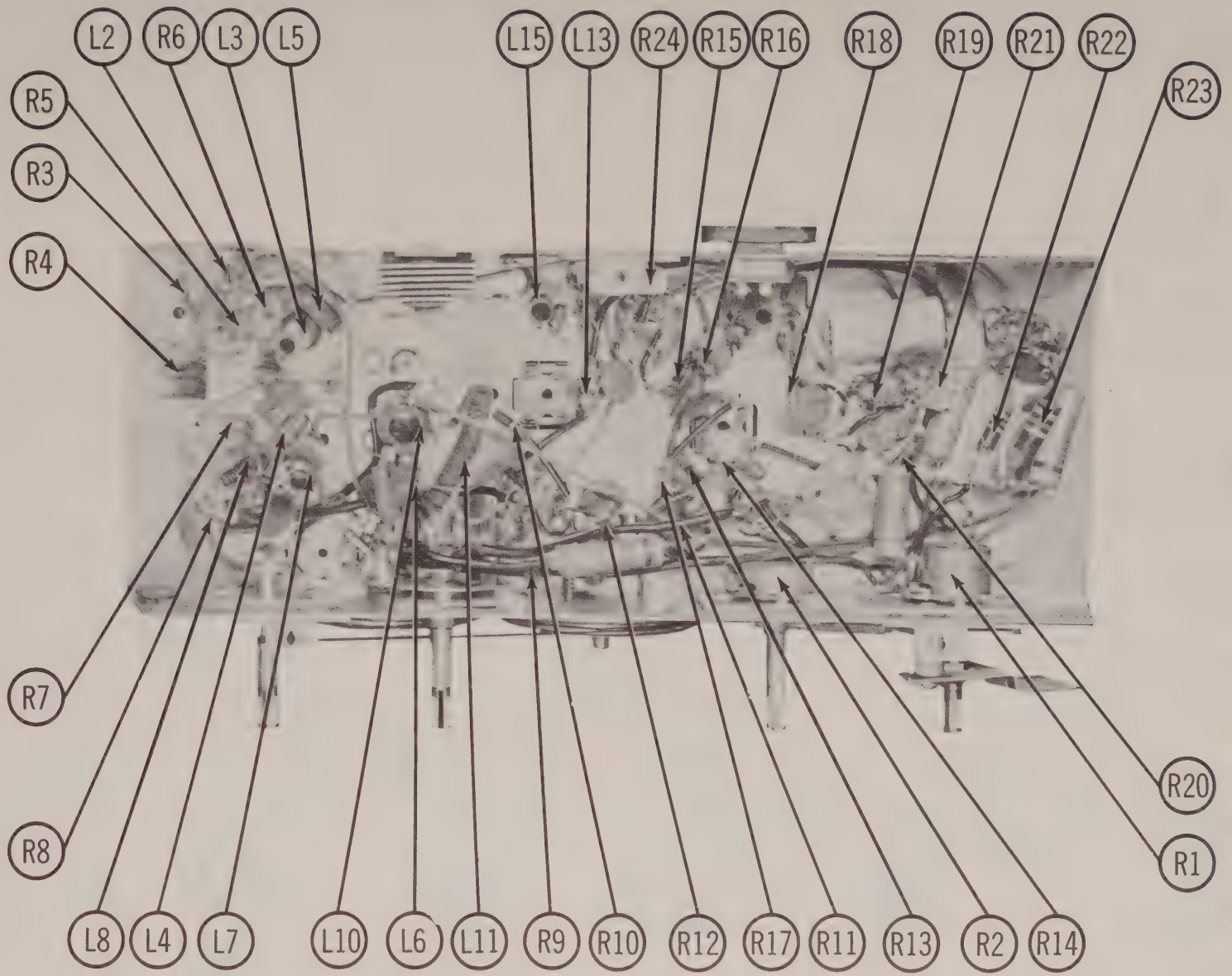


CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PROPERTY OF
L. F. HAWKENSHIP

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

To set pointer, turn tuning capacitor fully closed and set pointer parallel with base of dial.
Use isolation trasnformer, if available. If not, connect a .1MFD capacitor in series with low side of signal generator and B-.
Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.

AM ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.05MFD	High side to pin 1 (grid) of 12AU6 (V3). Low side to chassis.	455KC (400∿ Mod)	BC	Tuning gang fully open	Across voice coil	A1, A2 A3, A4	Adjust for maximum output. If isolation transformer is not used, reduce dummy antenna to .001MFD to reduce hum modulation.
2.		Loop	1620KC	"	"	"	A5	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.
3.		"	1400KC	"	Tune to 1400KC signal	"	A6	"
4.		"	600KC	"	Tune to 600KC signal	"		Check calibration. If necessary, bend slotted antenna rotor plates for maximum output. Repeat step 3.

FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM

Connect two matched 100KΩ (±1%) resistors in series from point Ⓐ to chassis. The junction of these two resistors is alignment point Ⓒ as shown on the schematic.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
5.	.01MFD	High side to pin 7 (grid) of 12BE6 (V2). Low side to chassis.	10.7MC (Unmod)	FM	Point of non-interference	DC probe to point Ⓐ. Common to chassis.	A7, A8, A9, A10	Adjust for maximum deflection.
6.	"	"	"	"	"	DC probe to point Ⓑ. Common to point Ⓒ.	A11	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60∿ modulation and 450KC sweep. Use 120∿ sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT SCOPE	ADJUST	REMARKS
5.	.01MFD	High side to pin 7 (grid) of 12BE6 (V2). Low side to chassis.	10.7MC (450KC Swp)	FM	Point of non-interference	Vert. amp. to point Ⓐ. Low side to chassis.	A7, A8, A9, A10	Disconnect stabilizing capacitor C2. Adjust for curve of maximum amplitude and symmetry similar to Fig. 1.
6.	"	"	"	"	"	Vert. amp. to point Ⓑ. Low side to chassis.	A11	Reconnect stabilizing capacitor C2. Adjust so that 10.7MC occurs at center of cross-over lines as in Fig. 2. SLIGHTLY retouch A10 for maximum amplitude and straightness of crossover lines.

FM RF ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
7.	270Ω carbon resistor	Across FM antenna terminals with high side thru 210Ω to terminal marked "FM".	109MC (Unmod)	FM	Tuning gang fully open.	DC Probe to point Ⓐ. Common to chassis.	A12	Adjust for maximum deflection.
8.	"	"	98MC	"	Tune to 98MC signal	"	A13	"

FIG. 1

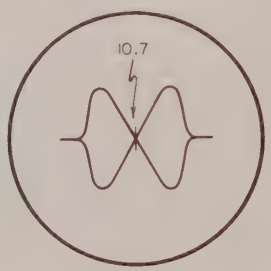


FIG. 2

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: SONORA PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amplifier	12BA6	12BA6	7BK	
V2	FM Converter-AM Oscillator	12BE6	12BE6	7CH	
V3	AM Mixer - 1st FM IF Amp.	12AU6	12AU6	7BK	
V4	1st AM IF Amp.-2nd FM IF Amp.	12BA6	12BA6	7BK	
V5	Ratio Det. AF Amp.	19T8	19T8	9E	
V6	Audio Output	50C5	50C5	7CV	

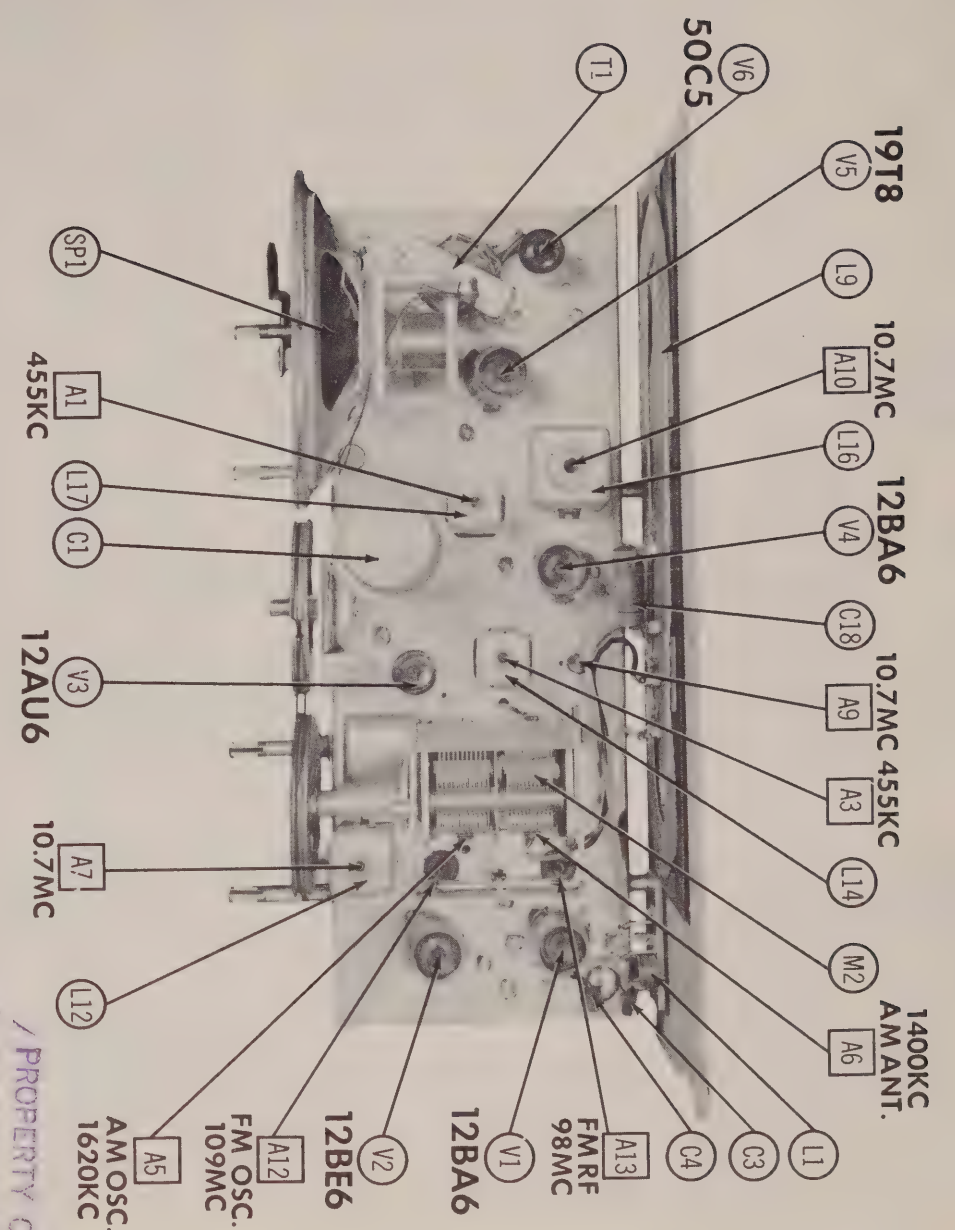
CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	RATING VOLT	SONORA PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	▲60	150	N-9528	AFH3-90		C037		FP266	TVL-2584	
B	■80	150						TC26	TVA-1205	
C	▲20	25								
C2	4	50	N-9685	PRS150/4		BR550		TC30	TVA-1303	
C3	1500		N-9596	BPD-0015	DD-152	K071	801-0015	DC-5215	5GA-D15	
C4	1500		N-9596	BPD-0015	DD-152	K071	801-0015	DC-5215	5GA-D15	
C5	22		N-9049	SI22	D6-220	TP22	GP1K-220	UC-5422	5GA-Q22	
C6	1500		N-9596	BPD-0015	DD-152	K071	801-0015	DC-5215	5GA-D15	
C7	1500		N-9596	BPD-0015	DD-152	K071	801-0015	DC-5215	5GA-D15	
C8	1500		N-9596	BPD-0015	DD-152	K071	801-0015	DC-5215	5GA-D15	
C9	1500		N-9596	BPD-0015	DD-152	K071	801-0015	DC-5215	5GA-D15	
C10	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C11	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C12	33		N-9577	SI33NP0	TCZ-33	TZ18	NP0K-330	ZT-5433	5TCC-Q33	
C13	30		N-9707	SI30NP0	TCZ-30	TZ17	NP0K-300			
C14	47		N-9738							
C15	25		N-9049	SI25NP0	TCZ-25		NP0K-250	ZT-5425	5TCC-Q25	
C16	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C17	100	500	N-2311	1469-0001		22R5T1		MC235	MS-31	
C18	.005	600	N-4894	P688-005	D6-502	CUB6D5	GP2-333-502	PT625	6TM-D5	
C19A	1500		N-9595	BPD-2X0015	DD3-152	DK071	812-0015	DCD-5215	5HK-2D15	
B	1500									
C20	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C21	3900	500	N-6892	1468-004		1R5D39		MCB243	1FM-34	
C22	25		N-9578	SI25	D6-250	TP25	GP1K-250	UC-5425	5GA-Q25	
C23	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C24A	4000		N-7774	BPD-2X004	DD3-402	DK078	822-004	DCD-524	5HK-2D4	
B	4000									
C25	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C26	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C27	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C28	10000		N-6482	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C29A	4000		N-7774	BPD-2X004	DD3-402	DK-078	822-004	DCD-524	5HK-2D4	
B	4000									
C30	100		N-9053	SI100	D6-101	TP34	GP1K-101	UC-531	5GA-T1	
C31	100		N-9053	SI100	D6-101	TP34	GP1K-101	UC-531	5GA-T1	
C32	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C33	100	500	N-9597	1469-00015		22R5T18		MCB237	MS-32	
C34	2200	500	N-6891	1464-002		1R5D22		MCB457	MS-22	
C35	.005	600	N-4894	P688-005	D6-502	CUB6D5	GP2-333-502	PT625	6TM-D5	
C36A	5000									
B	250		♦N-8215	♦PA-112-2	♦PC-71	♦112TM2	♦1406-02		♦T-4	
C										
C37	.005	600	N-4894	P688-005	D6-502	CUB6D5	GP2-333-502	PT625	6TM-D5	
C38	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	
C39	.01	400	N-1344	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C40	10000		N-6482	BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C41	.01	400		P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C42	5000		N-6272	BPD-005	DD-502	K080	801-005	DC-525	5HK-D5	

♦ Items C36A, C36B, C36C, R21A and R21B are combined in one unit. When replacing items separately items C36B and C36C should total 250MMF.

CHASSIS—TOP VIEW



PROPERTY OF L. F. BLANKENSHIP 3924 MEADE ST. DENVER COLO

PARTS LIST AND DESCRIPTIONS (Continued)

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	SONORA PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1	500KΩ	½	N-9861					Volume and switch
R2A	1 Meg		N-8159	Q11-137	A47-1Meg-S	AB-69	U-54	Tone
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R2A

RESISTORS

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	SONORA PART No.	IRC PART No.	
R3	680Ω	½	N-4228	BTS-680	
R4	68Ω	½	N-6485	BTS-68	
R5	470Ω	½	N-6011	BTS-470	
R6	470Ω	½	N-6011	BTS-470	
R7	22KΩ	½	N-6012	BTS-22K	
R8	470Ω	½	N-6011	BTS-470	
R9	3.3Meg	½	N-4062	BTS-3.3Meg	
R10	33Ω	½	N-4022	BTS-33	
R11	470Ω	½	N-6011	BTS-470	
R12	10KΩ	½	N-4895	BTS-10K	
R13	1 Meg	½	N-2976	BTS-1 Meg	
R14	47KΩ	½	N-7124	BTS-47K	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	SONORA PART No.	IRC PART No.	
R15	68Ω	½	N-6485	BTS-68	
R16	5600Ω	½	N-7400	BTS-5600	
R17	470Ω	½	N-6011	BTS-470	
R18	33KΩ	½	N-6717	BTS-33K	
R19	33KΩ	½	N-6717	BTS-33K	
R20	6.8Meg	½	N-4028	BTS-6.8Meg	
R21A	220KΩ	½	♦ N-8215	BTS-220K	
B	470KΩ	½		BTS-470K	
R22	180Ω	1	N-9537	BTA-180	
R23	560Ω	2	N-9539	BTB-560	
R24	27Ω	2	N-9705		

♦ Items R21A, R21B, C36A, C36B, C36C are combined in one unit.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	SONORA PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	
T1	2.3KΩ	3.4Ω	N-9430	A-3336	A-3031		Z1102	24S50A	

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA			NOTES
	SIZE	FIELD	V. C. IMP.	SONORA PART No.	JENSEN PART No.	QUAM PART No.	
SP1	5"	PM	3.4Ω	N-7980	ST-105 Mod. P5-X	5A1	

COILS (RF-IF)

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	SONORA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	FM Ant. Coil	0Ω		N-9530				
L2	Fil. Choke	3Ω		N-9525	19-1003		4608	3.3 Microhenries; IRC Part # CLA
L3	FM RF Coil	0Ω	0Ω	N-9604				Less slug; slug part # N-9603
L4	Fil. Choke	3Ω		N-9525	19-1003		4608	3.3 Microhenries; IRC part # CLA
L5	Fil. Choke	3Ω		N-9525	19-1003		4608	3.3 Microhenries; IRC part # CLA
L6	Fil. Choke	3Ω		N-9525	19-1003		4608	3.3 Microhenries; IRC part # CLA
L7	FM Osc. Coil	0Ω		N-9602				Less slug; slug part # N-9603
L8	Cathode Choke	0Ω		N-9527				
L9	AM Loop Ant.	.1Ω	2.1Ω	N-9598				
L10	AM Osc. Coil	7.5Ω	7.5Ω	N-9601	14-1060 †		71-Osc. †	Sec. tapped @ 6.5Ω & @ 7Ω
L11	RF Choke	0Ω		N-9526				
L12	1st FM IF	1.5Ω	1.5Ω	N-9600	16-3487 *	FM-251 ■	1451 ■	
L13	Fil. Choke	3Ω		N-9525	19-1003		4608	3.3 Microhenries; IRC part # CLA

CHASSIS—BOTTOM VIEW

ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	SONORA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L14	1st AM IF	9Ω	9Ω	N-9657	16-6758	BC-352	12-C1	
L15	2nd FM IF	.5Ω	.5Ω	N-9529				
L16	Ratio Det.	2.2Ω	.1ΩCT	N-9605	17-3488 ■	FM-252 ■	1453 ■	Tertiary winding =.35Ω
L17	2nd AM IF	9Ω	9Ω	N-9657	16-6758	BC-353	12-C2	

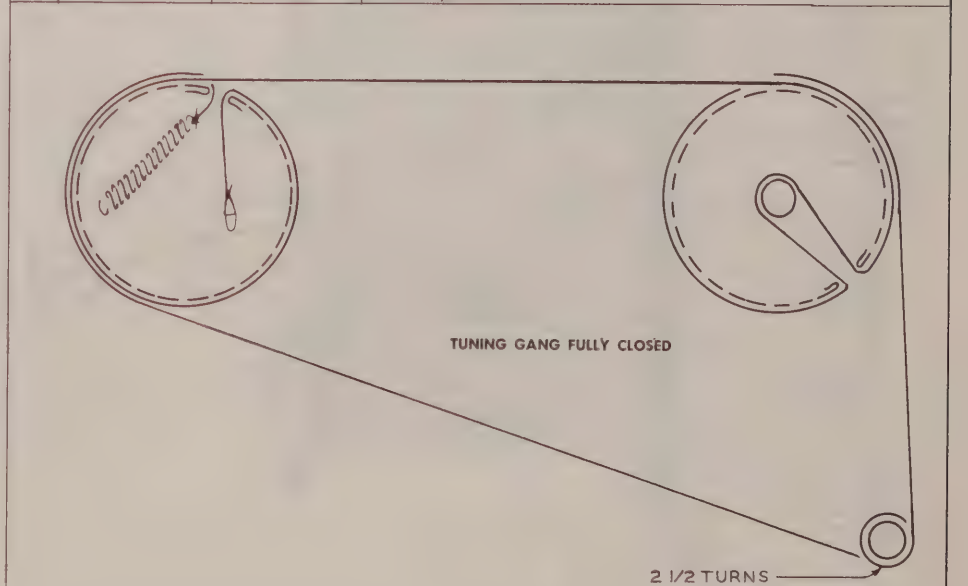
† Drill mounting hole.
* Drill mounting holes and use adaptor plate.
■ Drill mounting holes.

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA						NOTES
	CURRENT	PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	MALLORY PART No.	SARKES TARZIAN PART No.	SELETRON PART No.	
M1	.077ADC	N-9541	1004A	RS100	6S100	100	5M1	

MISCELLANEOUS

ITEM No.	PART NAME	SONORA PART No.	NOTES
M2	Tuning cap	N-9672	23-385MMF & 17-170MMF
M3	Switch	N-9523	Function, AM-FM



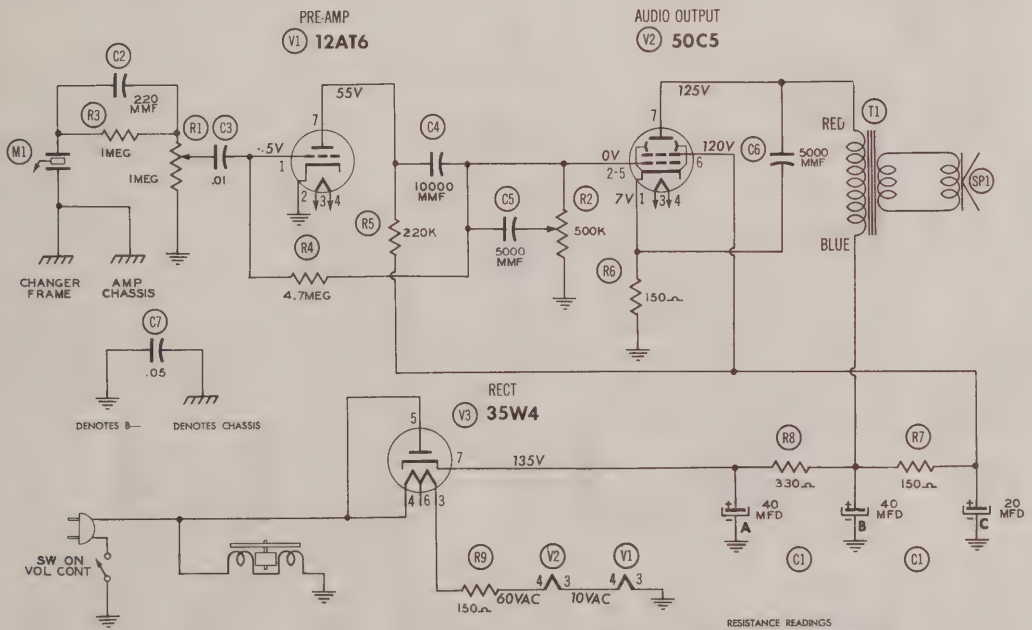
DIAL CORD STRINGING

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST
DENVER, COLORADO

STEELMAN
MODEL 3A4

TRADE NAME	Steelman Model 3A4
MANUFACTURER	Steelman Phono & Radio Co., Inc., 12-30 Anderson Ave., Mt. Vernon, N.Y.
TYPE SET	AC Operated Phono Amplifier With 3 Speed Automatic Record Changer
TUBES (Three)	Types 12AT6 AF Amp., 50C5 Audio Output, 35W4 Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles
RATING	.24 Amp. @ 117 Volts AC

FOR SERVICE INFORMATION ON RECORD CHANGER UNIT SEE V-M MODEL 950-PHOTOFACT SET #216-FOLDER #11 OR RECORD CHANGER MANUAL CM-5.



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V 1	12AT6	4.7Meg	0Ω	0Ω	14Ω	INF	INF	†220KΩ
V 2	50C5	150Ω	500KΩ	14Ω	64Ω	500KΩ	†480Ω	†515Ω
V 3	35W4	†330Ω	0Ω	220Ω	250Ω	250Ω	240Ω	200KΩ

† MEASURED FROM PIN 7 OF V3

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253-15

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PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: STEELMAN PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	AF Amplifier	12AT6	12AT6	7BT	
V2	Audio Output	50C5	50C5	7CV	
V3	Rectifier	35W4	35W4	5BQ	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: STEELMAN PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	40	150		PRS150/50-30-20		BBRT44215		3N532	TVA-3448	Red
B	40	150								Red
C	20	150								Green
C2	220	500		1468-00025	D6-221	5W5T25	GP2K-221	MC240	1FM-325	
C3	.01	600		P688-01	D6-103	CUB6S1	GP2-333-103	PT611	6TM-S1	
C4	10000			BPD-01	DD-103	K082	811-01	DC-511	5HK-S1	
C5	5000			BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C6	5000			BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C7	.05	400		P488-05	DF-503	CUB4S5		PT415	4TM-S5	

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: STEELMAN PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1 Meg	½	VC-42	Q13-137	AG-63-Z	BSK-70-S	U-53	Volume
B	Shaft		Not Req.	Not Req.	KSS-3	Not Req.	Not Req.	Attach to R1A
C	Switch		Not Req.	76-1	SWB	Not Req.	US-26	Attach to R1A
R2A	500KΩ	½	VC-44	Q11-133	AG-58-S	AB-59	U-50	Tone
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R2A

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: STEELMAN PART No.	IRC PART No.	NOTES
R3	1 Meg	½		BTS-1 Meg	
R4	4.7Meg	½		BTS-4.7Meg	
R5	220KΩ	½		BTS-220K	
R6	150Ω	½		BTS-150	

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: STEELMAN PART No.	IRC PART No.	NOTES
R7	150Ω	1		BTA-150	
R8	330Ω	1		BTA-330	
R9	150Ω	10			

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	REPLACEMENT DATA: STEELMAN PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	NOTES
T1	2.4KΩ	3.4Ω		A-3332	A-3025	S-1X ①	Z1101	TS-24S50 ①	① Drill one new mounting hole.

SPEAKER

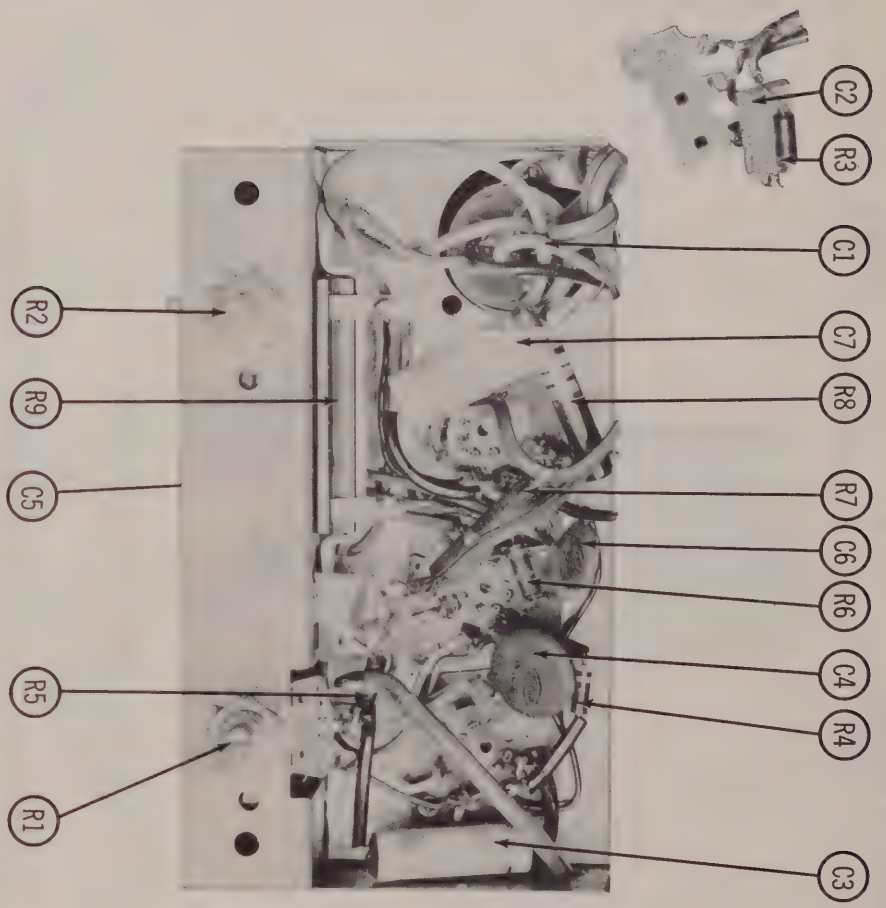
ITEM No.	RATINGS: SIZE	RATINGS: FIELD	RATINGS: V. C. IMP.	REPLACEMENT DATA: STEELMAN PART No.	JENSEN PART No.	QUAM PART No.	NOTES
SP1	5"	PM	3.4Ω		ST-105 Mod. P5-X	5A1	

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA: STEELMAN PART No.	ASTATIC PART No.: CARTRIDGE	ASTATIC PART No.: NEEDLE	SHURE PART No.: CARTRIDGE	SHURE PART No.: NEEDLE	ELECTRO-VOICE PART No.: CARTRIDGE	ELECTRO-VOICE PART No.: NEEDLE	REMARKS
M1		LDQ-1J	"Q" Q-33			46-0	0-1 0-3	

ASTATIC AND ELECTRO-VOICE NEEDLE LISTINGS SHOWN ABOVE ARE SPECIFIED FOR THE RESPECTIVE REPLACEMENT CARTRIDGES LISTED. FOR ORIGINAL CARTRIDGE NEEDLE REPLACEMENT SEE BELOW.

CHASSIS—BOTTOM VIEW



PHONO NEEDLE

(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

ITEM No.	REPLACEMENT DATA: PART No.	JENSEN PART No.	PERMO PART No.	WALCO PART No.	REMARKS
M2		*A-80LP(or) †A-81LP & *A-80 (or) †A-81	*A-357(or) †A-305 (or) ♦A-305D & *C-308 (or) †C-327(or) ♦C-327D	*W-2MGA (or) †W-2MGS & *W-2A (or) †W-2S	* Metal † Jewel ♦ Diamond

PROPERTY OF
L. F. BLANKENSHIP
3924 MEADE ST
DENVER, COLORADO

ULTRATONE
MODEL 400

ULTRATONE
MODEL 400

TRADE NAME	Ultratone Model 400
MANUFACTURER	Audio Industries, Michigan City, Indiana
TYPE SET	AC Operated Phono Amplifier With 3 Speed Automatic Record Changer
TUBES (Four)	Types 12AX7 AF Amp.-Phase Inv., (2) 35L6GT Audio Output, 35Z5GT Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .3 Amp. @ 117 Volts AC

FOR SERVICE INFORMATION ON RECORD CHANGER UNIT - SEE V-M MODEL 950-PHOTOFACT SET 216 - FOLDER 11 OR RECORD CHANGER MANUAL CM-5.

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PARTS LIST AND DESCRIPTIONS

ULTRATONE MODEL 400

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: ULTRATONE PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	AF Amplifier-Phase Inverter	12AX7	12AX7	9A	
V2	Audio Output	35L6GT	35L6GT	7S	
V3	Audio Output	35L6GT	35L6GT	7S	
V4	Rectifier	35Z5GT	35Z5GT	6AD	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: ULTRATONE PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	40	150		PRS150/50-30-20		BBRT44215		3N532	TVA-3448	Red
B	40	150								Red
C	20	150								Yellow
D	20	25								Blue
C2	330	500		1468-00035					1FM-335	
C3	.1	200		P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C4	.05	200		P288-05	DF-503	PJ2S5		PT415	2TM-S5	
C5	.1	200		P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C6	.1	200		P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C7	.1	200		P288-1	DF-104	PJ2P1		PT401	2TM-P1	
C8	.05	400		P488-05	DF-503	PTE4S5		PT415	4TM-S5	

CONTROLS

ITEM No.	RATING: RESISTANCE	RATING: WATTS	REPLACEMENT DATA: ULTRATONE PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	100KΩ	½	408G	Q13-128	AG-51-Z	AB-41	U-39	Tone
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R1A
R2A	2.5Meg	½	401E			ABT-79		Volume-tapped @ 400K
B	Shaft		Not Req.			AK-4		Attach to R2A

RESISTORS

ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ULTRATONE PART No.	IRC PART No.	NOTES
R3	270KΩ	½		BTS-270K	
R4	22KΩ	½		BTS-22K	
R5	4500Ω	½			
R6	270KΩ	½		BTS-270K	
R7	47KΩ	½		BTS-47K	
R8	10KΩ	½		BTS-10K	
R9	270KΩ	½		BTS-270K	
R10	10KΩ	½		BTS-10K	
R11	510KΩ	½		BTS-510K	

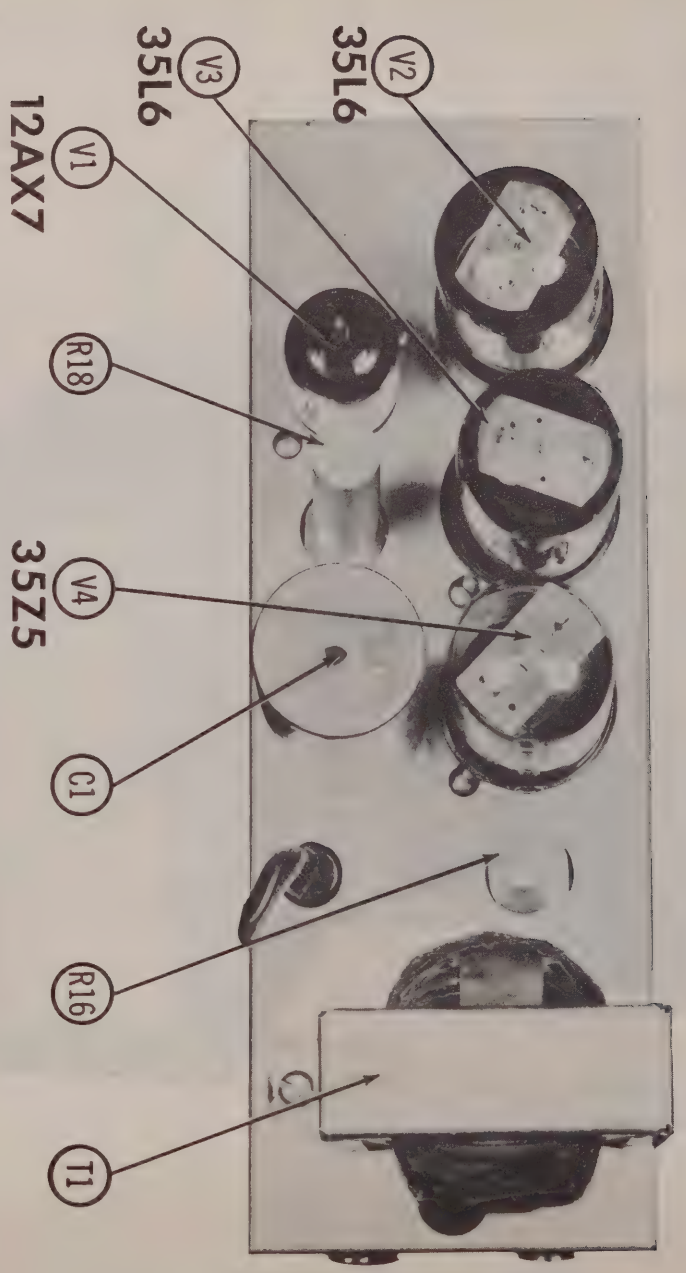
ITEM No.	RATING: OHMS	RATING: WATT	REPLACEMENT DATA: ULTRATONE PART No.	IRC PART No.	NOTES
R12	82Ω	2			
R13	510KΩ	½		BTS-510K	
R14	10KΩ	½		BTS-10K	
R15	100Ω	2			
R16	56Ω	10			
R17	22Ω	1			
R18	600Ω	10			

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE: PRI.	IMPEDANCE: SEC.	REPLACEMENT DATA: ULTRATONE PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	NOTES
T1	4.4KΩ	.1Ω		A-3830	A-2905 ①	S-57Z	Z1004 ①	24S51	

① Drill one new mounting hole.

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA			NOTES
	SIZE	FIELD	V. C. IMP.	ULTRATONE PART No.	JENSEN PART No.	QUAM PART No.	
SP1	5"	PM	3Ω	2614		52A21	Speakers used in parallel
SP2	5"	PM	3Ω	2614		52A21	
SP3	5"	PM	3Ω	2614		52A21	

PHONO CARTRIDGE

ITEM No.	REPLACEMENT DATA							REMARKS
	ULTRATONE PART No.	ASTATIC PART No.		SHURE PART No.		ELECTRO-VOICE PART No.		
		CARTRIDGE	NEEDLE	CARTRIDGE	NEEDLE	CARTRIDGE	NEEDLE	
M1						43	O-2 or S-2	

ELECTRO-VOICE NEEDLE LISTINGS SHOWN ABOVE ARE SPECIFIED FOR THE RESPECTIVE REPLACEMENT CARTRIDGE LISTED. FOR ORIGINAL CARTRIDGE NEEDLE REPLACEMENT SEE BELOW.

PHONO NEEDLE

(FOR REPLACEMENT IN ORIGINAL EQUIPMENT CARTRIDGE)

ITEM No.	REPLACEMENT DATA				REMARKS
	ULTRATONE PART No.	JENSEN PART No.	PERMO PART No.	WALCO PART No.	
M2		† S-66	† AC-434 or ♦† AC-434D1 or †♦ AC-434D2 or ♦ AC-434D	† W-75TPS	† Jewel ♦ Diamond

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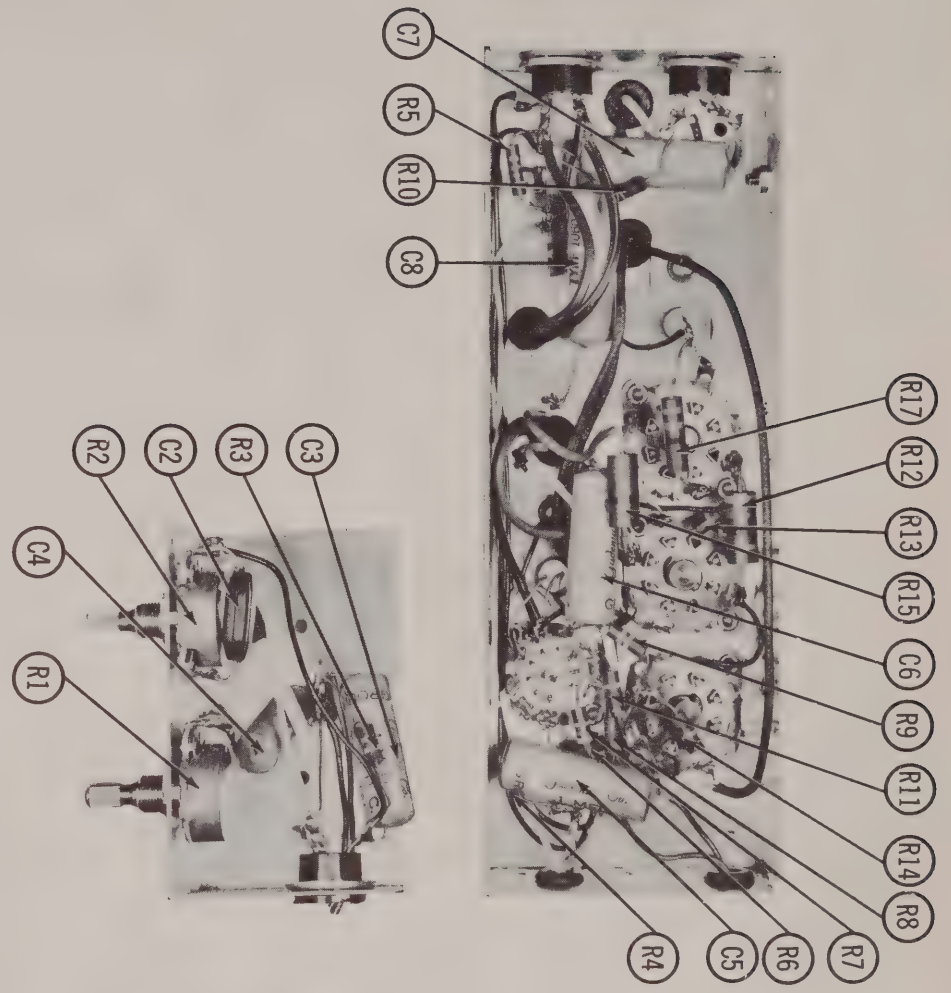
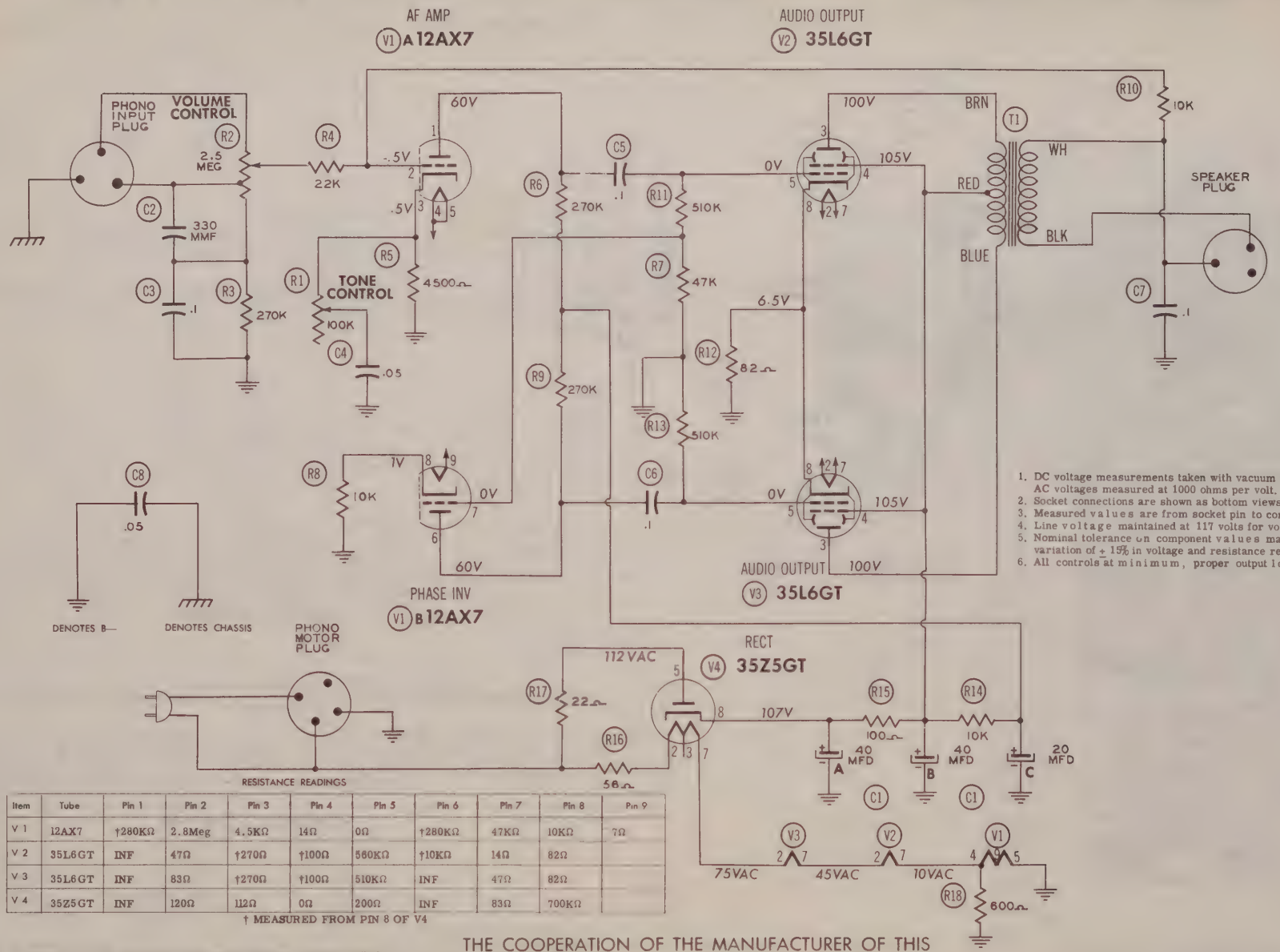
CHASSIS—BOTTOM VIEW



ULTRATONE MODEL 400

ULTRATONE MODEL 400



1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	12AX7	†280KΩ	2.8Meg	4.5KΩ	14Ω	0Ω	†280KΩ	47KΩ	10KΩ	7Ω
V 2	35L6GT	INF	47Ω	†270Ω	†100Ω	560KΩ	†10KΩ	14Ω	82Ω	
V 3	35L6GT	INF	83Ω	†270Ω	†100Ω	510KΩ	INF	47Ω	82Ω	
V 4	35Z5GT	INF	120Ω	112Ω	0Ω	200Ω	INF	83Ω	700KΩ	

† MEASURED FROM PIN 8 OF V4

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MODEL H-827T21

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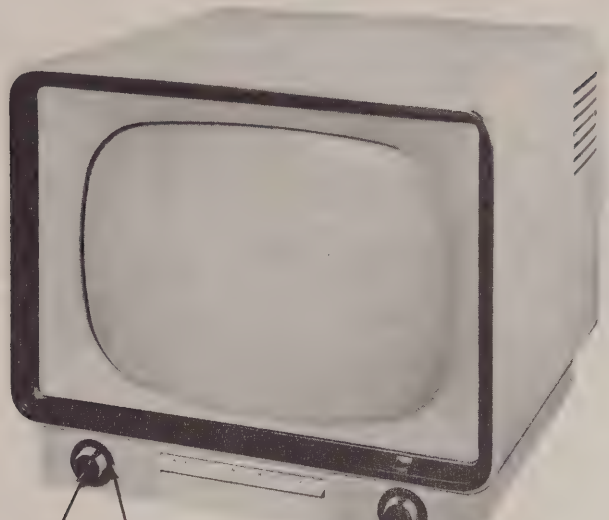

WESTINGHOUSE MODEL H-827T21 (Ch. V-2263-15)

TRADE NAME	Westinghouse	MODELS	CHASSIS
		H-769T21	V-2263-12, -14
		H-770T21, A, H-771T21, A, H-786K21, H-787K21, H-822K21, H-823K21	V-2263-12
		H-827T21, H-828T21, H-829T21	V-2263-12, -13, -14, -15
		H-830K21, H-831K21	V-2263-11, -12, -13, -14
		H-834K21, H-835K21	V-2263-22
		H-836T21	V-2263-35
		H-838K21, H-839K21	V-2263-15
		H-769TU21, H-770TU21, A, H-771TU21, A, H-786KU21, H-787KU21, H-822KU21, H-823KU21, H-838KU21, H-839KU21	V-2273-122
		H-827TU21, H-828TU21, H-829TU21	V-2273-122, -134
		H-830KU21, H-831KU21	V-2273-111, -122, -124, -132, -134
		H-834KU21, H-835KU21	V-2273-222
		H-836TU21	V-2273-322

MANUFACTURER	Westinghouse Electric Corp., Television & Radio Div., Metuchen, N.J.
TYPE SET	Television Receiver
TUBES	Twenty-two
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING 1.82 Amp. @ 117 Volts AC
TUNING RANGE	Channels 2 thru 13 VHF, 14 thru 83 UHF, Video IF 45.75MC, Sound IF 41.25MC (Intercarrier)

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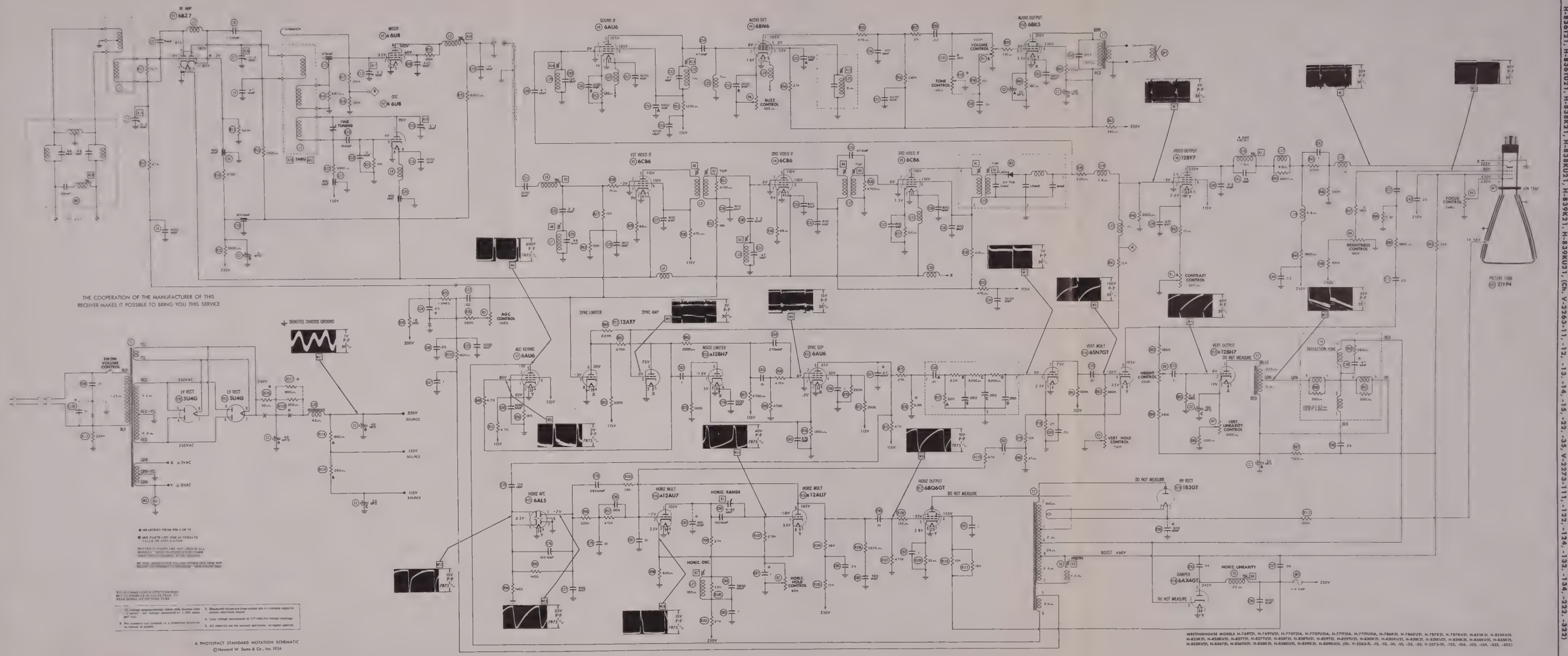
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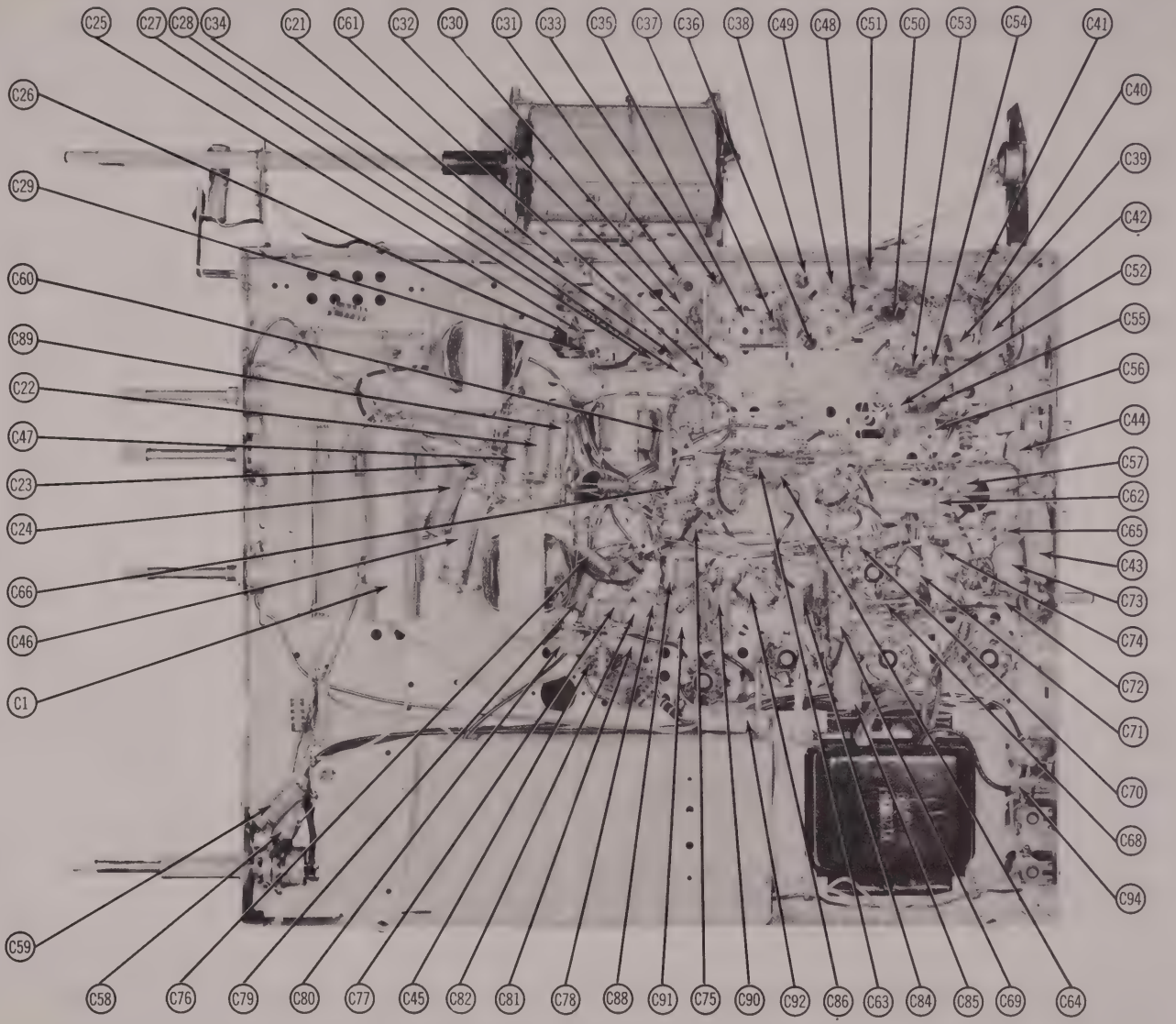
CHASSIS TOP VIEW

WESTINGHOUSE MODELS H-769T21, H-769TU21, H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-787K21, H-787KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-830K21, H-830KU21, H-831K21, H-831KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-836T21, H-836TU21, H-838K21, H-838KU21, H-839K21, H-839KU21, (Ch. V-2263-11, -12, -13, -14, -15, -22, -35, V-2273-111, -122, -124, -132, -134, -222, -322)



CHASSIS BOTTOM VIEW-CAPACITOR IDENTIFICATION

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39[illegible] St.
DENVER, COLORADO

WESTINGHOUSE MODELS H-769T21, H-769TU21, H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-787K21, H-787KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-830K21, H-830KU21, H-831K21, H-831KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-836T21, H-836TU21, H-838K21, H-838KU21, H-839K21, H-839KU21 (Ch. V-2265-11, -12, -13, -14, -15, -32, -35, V-2273-111, -122, -124, -132, -134, -222, -322)

TUBE PLACEMENT CHART

PROPERTY OF
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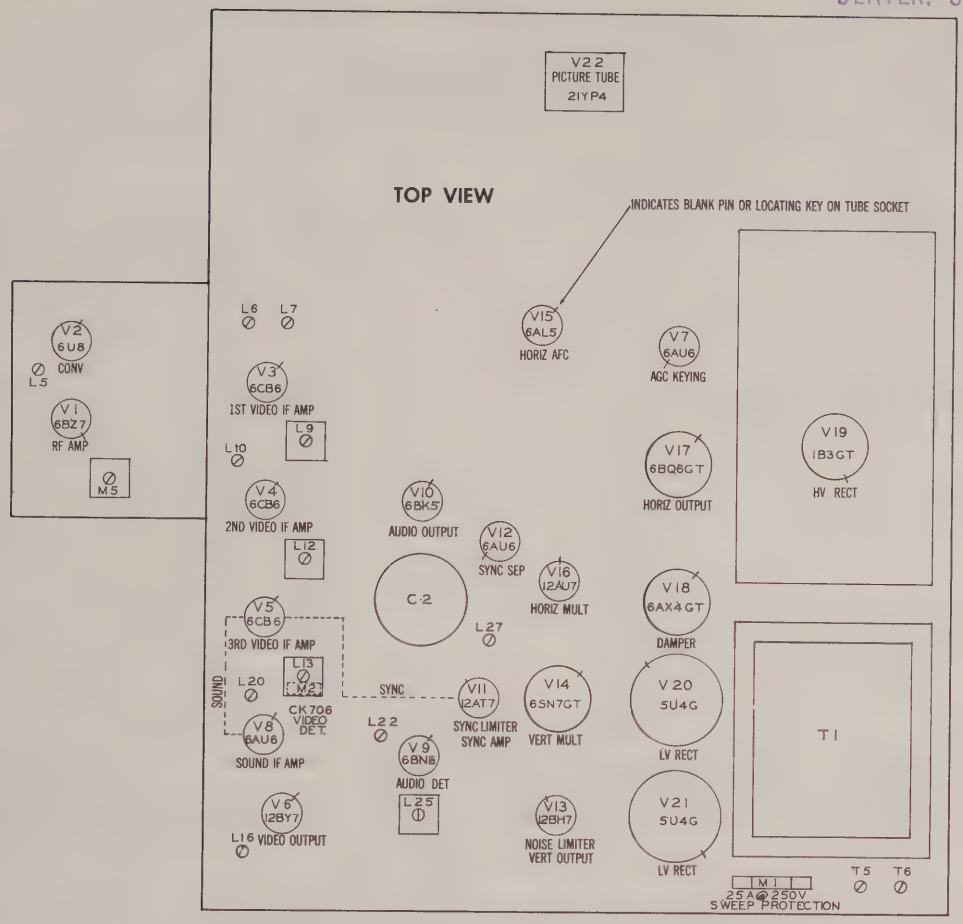

TUBE FAILURE CHECK CHART

The following chart lists tubes whose failures are most likely to produce the indicated symptoms. Refer to tube placement chart for location and type of tube.

POWER SUPPLY FAILURE
No raster, no sound - V20, V21

LOSS OF PICTURE OR SOUND
No pic, no sound, has raster - V2, V3, V4, V5
No pic, no sound, has snow - V1, V2, V3
No pic, has sound, has raster - V6, V22
Has pic, no sound - V8, V9, V10
Overloaded picture - V7

SYNC FAILURE
No vert. sync - V12, V14
No horiz. sync - V12, V15, V16
No vert. or horiz. sync - V11, V12, V13

SWEEP FAILURE
No raster, has sound - V16, V17, V18, V19, V22, Fuse (M1)
No vertical deflection - V13, V14
Poor vert. linearity or foldover - V13, V14
Poor horiz. linearity or foldover - V16, V17, V18
Narrow picture - V16, V17, V18, V19, V20, V21
Vert. off freq. - V12, V14
Horiz. off freq. - V12, V15, V16

WESTINGHOUSE MODELS H-769T21, H-769TU21, H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-787K21, H-787KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-830K21, H-830KU21, H-831K21, H-831KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-836T21, H-836TU21, H-838K21, H-838KU21, H-839K21, H-839KU21, (Ch. V-2263-11, -12, -13, -14, -15, -22, -35, V-2273-111, -122, -124, -132, -134, -222, -322)

ALIGNMENT INSTRUCTIONS

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

The high voltage lead should be securely taped and kept away from the chassis. Do not remove the horizontal multivibrator tube (V16) to disable the high voltage.

VIDEO IF ALIGNMENT

Remove V1 (6BZ7) from its socket to minimize the possibility of undesirable beat response during alignment.
Connect a 470MMF capacitor across the vertical input terminals of scope.
Connect the negative lead of a 9 volt bias supply to the ungrounded side of C23. Connect the positive lead to chassis.
If a separate marker generator is used couple its output loosely to the sweep generator output cable.
If peaks appear at two different slug settings, use the one at farthest counter clockwise position.
Use high scope gain and only enough sweep generator output to provide usable pattern on scope .
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
1.	Direct	High side to pin 1 (grid) of 6CB6 (V5). Low side to chasssis near V5.	44MC (10MC Swp)	42.25MC 43.0MC 44.0MC 45.0MC 45.75MC	13	Vert. Amp. thru 47KΩ to point (A). Low side to chassis.	A1, A2	Attach detuning clips (use alligator clips) to pin 5 (plate) of V3 and V4. Adjust A1 for maximum gain at 44MC. Adjust A2 for symmetrical response with markers as shown in Fig. 1. Remove detuning clips from pin 5 of V3 and V4.
2.	"	High side to pin 1 (grid) of 6CB6 (V3). Low side to chassis near V3.	Not used	47.25MC (400∿Mod)	"	"	A3	Adjust for MINIMUM 400∿ response on scope.
3.	"	High side to pin 1 (grid) of 6CB6 (V4). Low side to chassis near V4.	44MC (10MC Swp)	42.25MC 43.0MC 44.0MC 45.0MC 45.75MC	"	"	A4, A5	Attach detuning clip to pin 5 (plate) of V3. Adjust A4 for maximum gain at 44MC. Adjust A5 for symmetrical response with markers as shown in Fig. 2. Remove detuning clip from pin 5 of V3.
4.	"	High side to pin 1 (grid) of V3. Low side to chassis near V3.	"	41.25MC 42.25MC 43.0MC 44.0MC 45.0MC 45.75MC 47.25MC	"	"	A6, A7 A10	Detune A10 (on tuner) several turns counter clockwise. Adjust A6 for maximum response at 44MC. Adjust A7 for symmetrical response with markers as shown in Fig.3. Adjust A10 so that dip it produces on response is centered at 44MC. Replace RF amplifier tube (V1) in its socket.
5.	Fig. 5	Thru matching network (Fig.5) across antenna terminals.	213MC (10MC Swp)	41.25MC 42.25MC 43.0MC 44.0MC 45.0MC 45.75MC 47.25MC	"	"	A8, A9	Set fine tuning control to its mid-range position. Clip the high side of the marker generator to the converter (V2) tube shield (leave low side disconnected). Adjust A9 for symmetrical response as shown in Fig. 4. Adjust A8 for MINIMUM marker amplitude at 41.25MC.

4.5MC TRAP ALIGNMENT

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
6.	.001MFD	High side to point (A). Low side to chassis.	Not used	4.5MC (Unmod)	Any Unused Channel	Use VTVM. DC probe thru detector probe (Fig.6) to pin 11 of picture tube. Common to chassis.	A11	Adjust for MINIMUM deflection.

SOUND IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

Use frequency modulated signal with 60∿ modulation and 15KC sweep. Use 120∿ sawtooth voltage in scope for horizontal deflection.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
7.	.001MFD	High side to point (A). Low side to chassis.	4.5MC (15KC Swp)	4.5MC	Any Unused Channel	Vert. Amp. across volume control	A12	Set generator to give a strong signal and adjust A12 for maximum response at 4.5MC.
8.	"	"	"	"	"	"	A13, A14	Set generator to give minimum useful indication on scope. Adjust A13 and A14 for maximum response centered about 4.5MC. Retouch A12 for maximum response at 4.5 MC.
9.	"	"	Not used	4.5MC (400∿Mod)	"	"	R6	Starting with a very low signal input, gradually increase the level at the same time rotating the buzz control (R6) back and forth until the signal level reaches the point where the AM output on the scope dips to zero with a rise on each side as R6 is rotated. Set R6 for zero output at this signal level.

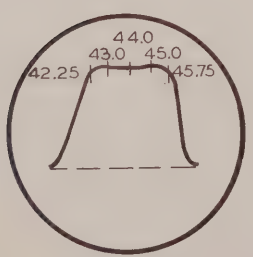

FIG. 1

FIG. 2

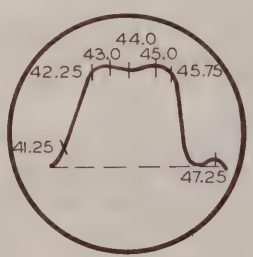

FIG. 3

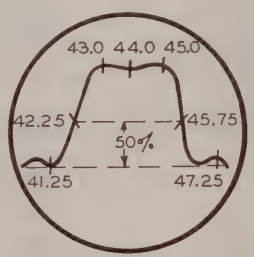

FIG. 4

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ALIGNMENT INSTRUCTIONS (cont)

SOUND IF ALIGNMENT USING A TV SIGNAL

Tune the receiver to a TV station and connect an attenuator between receiver and antenna so that the signal input to receiver may be varied from weak to strong.
Set the buzz control (R6) to its mid-range position. Apply a strong signal and adjust A12 for maximum program sound. If two widely separated peaks appear use the one with A12 furthest counter clockwise.
If two peaks occur within a narrow range of adjustment, the signal strength being applied is too low, or the buzz control is improperly adjusted.
Reduce the signal to its lowest useable level and adjust A12, A13 and A14 for maximum program sound. If two peaks appear at differenct slug settings use the one at farthest counter clockwise position.
Readjust signal input to its lowest useable level and recheck setting of A13 and A14.
Apply a very weak signal and adjust R6 for minimum noise. Do not leave R6 at maximum counter clockwise position.

RF AND MIXER ALIGNMENT FOR TUNER V- 14170 USED IN CHASSIS V2263-15

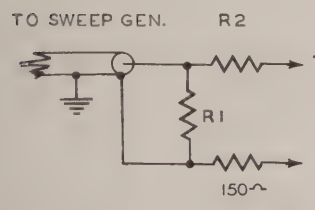
Disconnect the white wire (AGC Bus) from tuner terminal "D". Connect the negative side of a 1.5 volt battery to terminal "D".
Connect the positive side to chassis.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
The series resonant trap (A18) should be adjusted in the field whenever local interference on channel 2 is encountered.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
10.	Fig. 5	Thru matching network (Fig. 5) across antenna terminals.	207MC (12MC Swp)	205.25MC 209.75MC	12	Vert. Amp. thru 10KΩ to point (B). Low side to tuner chassis.	A15, A16 A17	Adjust for response curve similar to Fig. 7 with markers above 90%.
11.	"	"	213MC (12MC Swp)	211.25MC 215.75MC	13	"		If markers fall below 70% on any channel make compromise adjustment of A15, A16 and A17 with channel switch set to that channel, then check all other channels to see that they have not been seriously affected.
			201MC (12MC Swp)	199.25MC 203.75MC	11			
			195MC (12MC Swp)	193.25MC 197.75MC	10			
			189MC (12MC Swp)	187.25MC 191.75MC	9			
			183MC (12MC Swp)	181.25MC 185.75MC	8			
			177MC (12MC Swp)	175.25MC 179.75MC	7			
			85MC (12MC Swp)	83.25MC 87.75MC	6			
			79MC (12MC Swp)	77.25MC 81.75MC	5			
			69MC (12MC Swp)	67.25MC 71.75MC	4			
			63MC (12MC Swp)	61.25MC 65.75MC	3			
			57MC (12MC Swp)	55.25MC 59.75MC	2			

OSCILLATOR ALIGNMENT (TUNER V-14170)

Complete oscillator alignment may not be necessary.
If the oscillator seems to be off frequency approximately the same amount for a majority of the channels it may be possible to correct them in one step using A19. It should be noted that this is an all channel oscillator circuit adjustment and should not be used to correct any individual channel.
If adjustment of A19 will not bring all channels well within the range of the fine tuning control it will be necessary to adjust the channel strip adjustment for each channel that is off frequency. The channel oscillator adjustment screws are reached through a hole just above the channel switch shaft. The correct adjustment screw is accessible thru this hole as the channel switch is turned to each channel.
Leave the bias connected as under "RF and Mixer " alignment.
Connect the synchronized sweep voltage from the sweep generator to the horizontal input of the oscilloscope for horizontal deflection.
The sweep generator output lead should be terminated with its characteristic impedance, usually 50 ohms.
Set the fine tuning control to the mid-position of its range.

	DUMMY ANTENNA	SWEEP GENERATOR COUPLING	SWEEP GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
12.	Fig. 5.	Thru matching network (Fig. 5) across antenna terminals.	213MC (10MC Swp)	211.25MC 215.75MC	13	Vert. Amp. thru 47KΩ to point (A). Low side to chassis	A20	Adjust to place sound marker in trap notch as in Fig. 8. Video marker should be at 50%. Restore tuner AGC lead to its original connection at tuner terminal "D".
			207MC (10MC Swp)	205.25MC 209.75MC	12		A21	
			201MC (10MC Swp)	199.25MC 203.75MC	11		A22	
			195MC (10MC Swp)	193.25MC 197.75MC	10		A23	
			189MC (10MC Swp)	187.25MC 191.75MC	9		A24	
			183MC (10MC Swp)	181.25MC 185.75MC	8		A25	
			177MC (10MC Swp)	175.25MC 179.75MC	7		A26	
			85MC (10MC Swp)	83.25MC 87.75MC	6		A27	
			79MC (10MC Swp)	77.25MC 81.75MC	5		A28	
			69MC (10MC Swp)	67.25MC 71.75MC	4		A29	
			63MC (10MC Swp)	61.25MC 65.75MC	3		A30	
			57MC (10MC Swp)	55.25MC 59.75MC	2		A31	



Z0=SWEEP CABLE IMPEDANCE.

Z0	R1	R2
50Ω	56Ω	120Ω
72Ω	82Ω	110Ω

FIG. 5

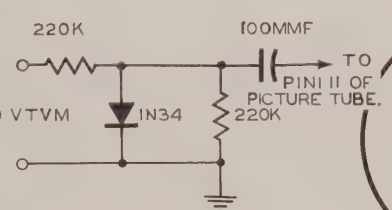


FIG. 6

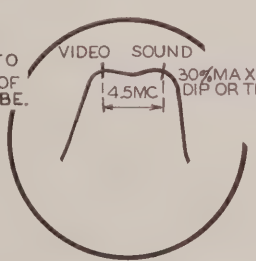


FIG. 7

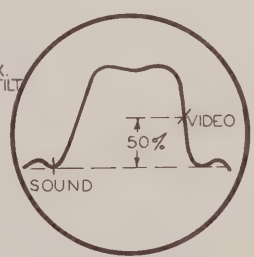
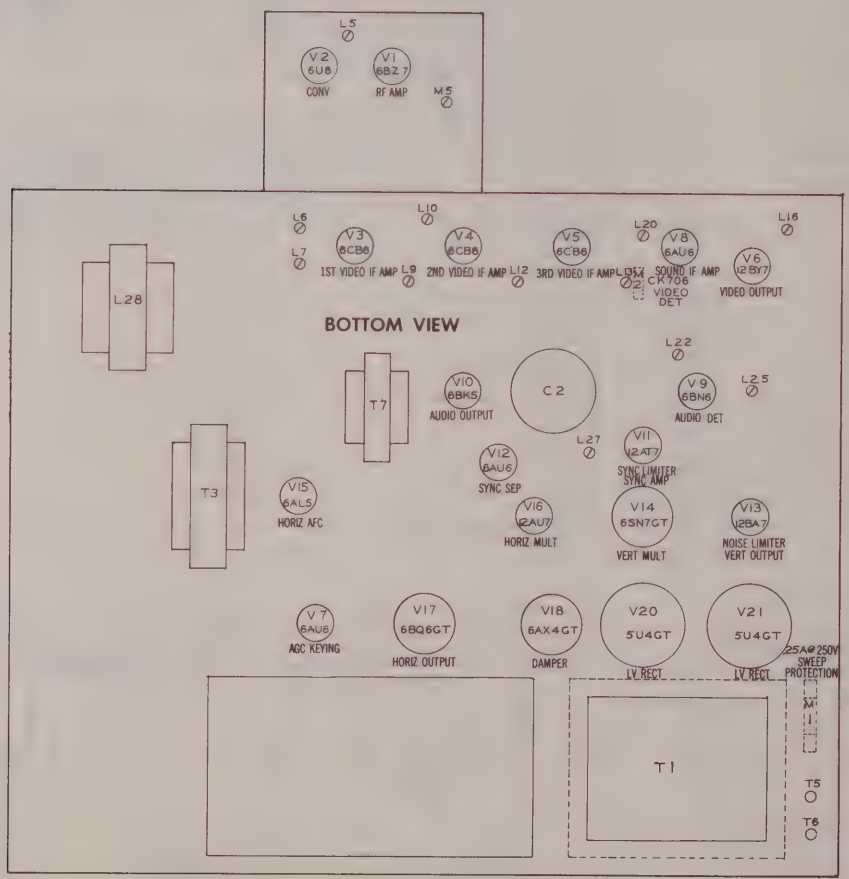


FIG. 8

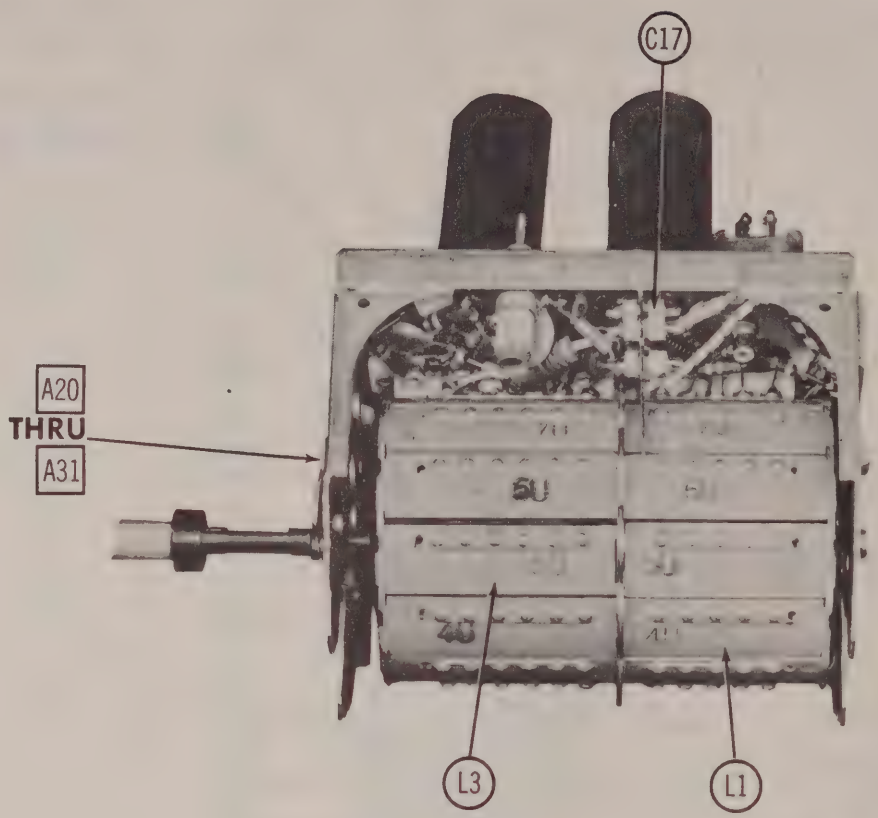
RESISTANCE MEASUREMENTS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V 1	6BZ7	†5.5KΩ	300KΩ	INF	0Ω	.1Ω	INF	147KΩ	0Ω	0Ω
V 2	6U8	†5KΩ	200KΩ	†112KΩ	0Ω	.1Ω	†12KΩ	0Ω	0Ω	10KΩ
V 3	6CB6	110KΩ	68Ω	.1Ω	0Ω	†2.8KΩ	†2.8KΩ	0Ω		
V 4	6CB6	110KΩ	68Ω	.1Ω	0Ω	†2.8KΩ	†2.8KΩ	0Ω		
V 5	6CB6	.4Ω	150Ω	.1Ω	0Ω	†2.8KΩ	†2.8KΩ	0Ω		
V 6	12BY7	300Ω	3.3KΩ	0Ω	.1Ω	.1Ω	0Ω	†3.9KΩ	†2.2KΩ	0Ω
V 7	6AU6	†15KΩ	†7KΩ	0Ω	.1Ω	1.3Meg	†2.5KΩ	†7KΩ		
V 8	6AU6	.6Ω	0Ω	.1Ω	0Ω	†3.4KΩ	†3.4KΩ	120Ω		
V 9	6BN6	250Ω	7Ω	0Ω	.1Ω	†27KΩ	6Ω	†330KΩ		
V 10	6BK5	†1KΩ	100KΩ	100KΩ	.1Ω	0Ω	180Ω	100KΩ	1.5KΩ	†10.5KΩ
V 11	12AT7	†10KΩ	15KΩ	0Ω	.1Ω	.1Ω	†120KΩ	100KΩ	0Ω	0Ω
V 12	6AU6	1Meg	0Ω	0Ω	.1Ω	†25KΩ	†180KΩ	1.2KΩ		
V 13	12BH7	▲10KΩ	2.2Meg	2KΩ	.1Ω	.1Ω	1Meg	1Meg	1.2KΩ	0Ω
V 14	6SN7GT	60KΩ	†100KΩ	1KΩ	1Meg	▲395KΩ	1KΩ	.1Ω	0Ω	
V 15	6AL5	1Meg	0Ω	0Ω	.1Ω	1Meg	0Ω	2Meg		
V 16	12AU7	†54KΩ	2.7Meg	820Ω	.1Ω	.1Ω	†66KΩ	400KΩ	820Ω	0Ω
V 17	6BQ6GT	INF	0Ω	30Ω	†9KΩ	470KΩ	INF	.1Ω	33Ω	TOP CAP ▲21Ω
V 18	6AX4GT	INF	INF	1.2Meg	INF	†65Ω	INF	.1Ω	0Ω	
V 19	1B3GT		PINS	1 - 8	HAVE	INF	RESISTANCE			TOP CAP ▲970Ω
V 20	5U4G	INF	20KΩ	INF	13Ω	INF	14Ω	INF	20KΩ	
V 21	5U4G	INF	20KΩ	INF	13Ω	INF	14Ω	INF	20KΩ	
V 22	21YP4	0Ω	1.5Meg	PIN 6 ▲70KΩ	PIN 10 ▲35KΩ	PIN 11 200KΩ	PIN 12 .1Ω			

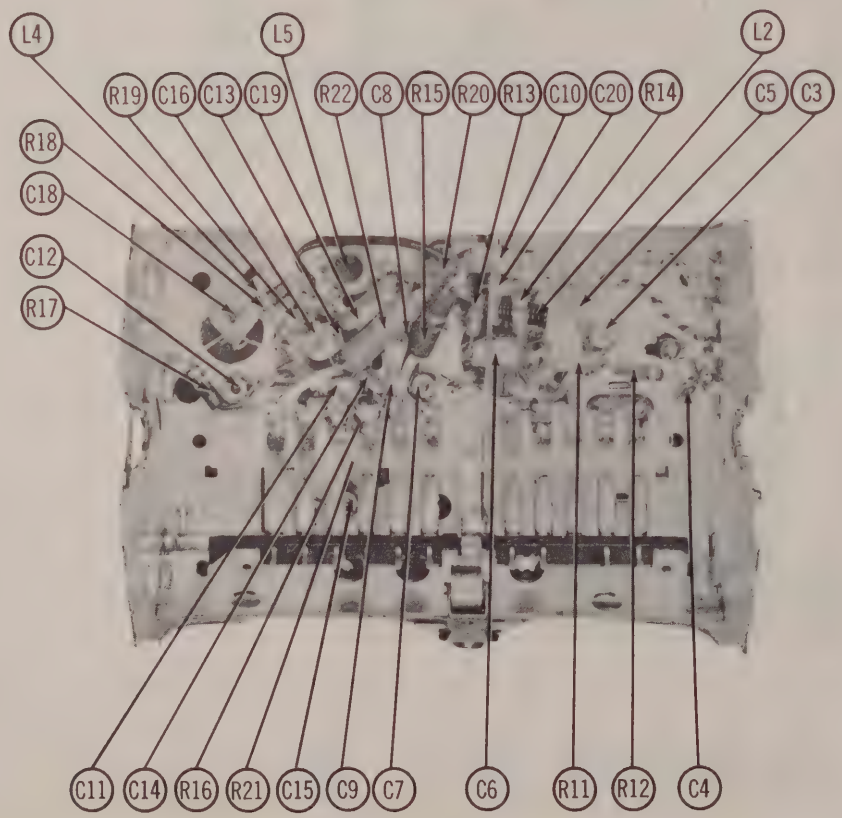
† MEASURED FROM PIN 8 OF V21
▲ MEASURED FROM PIN 3 OF V18



TUBE PLACEMENT CHART



RF TUNER-RIGHT SIDE



RF TUNER-BOTTOM VIEW

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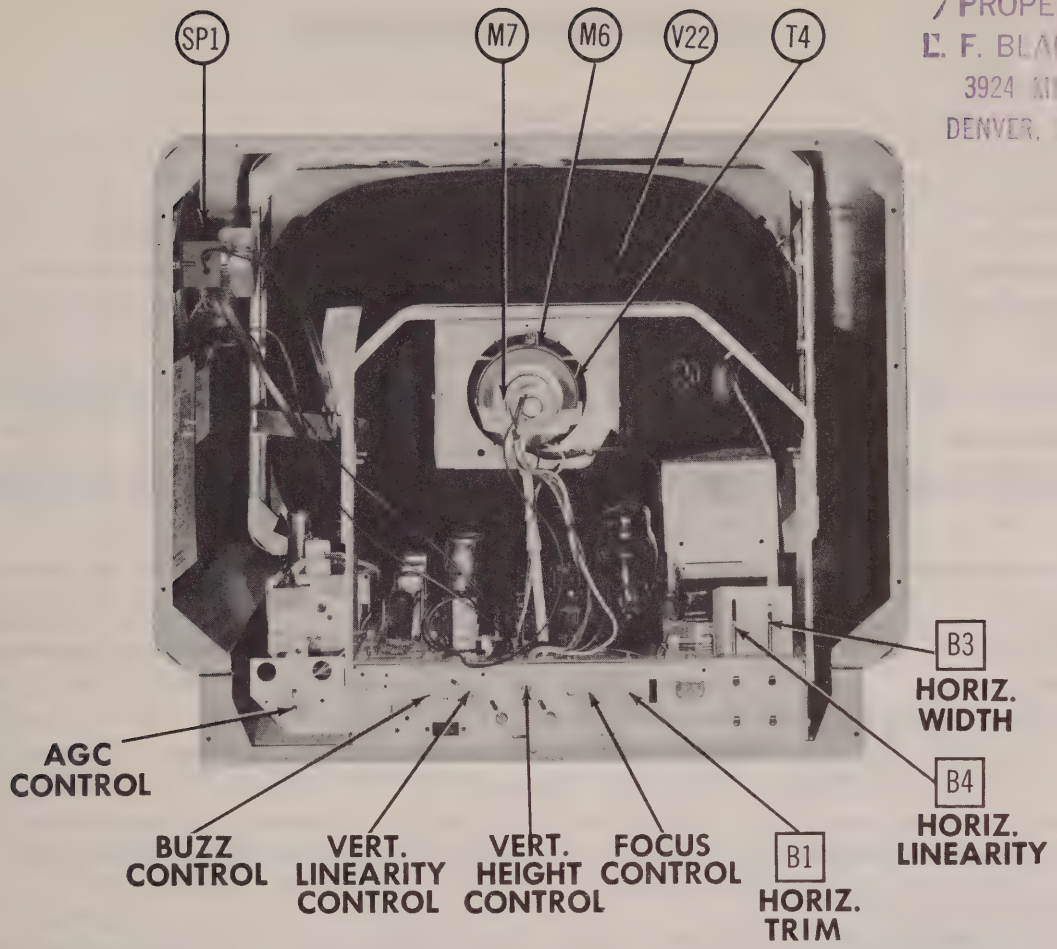
DENVER, COLO



CABINET—REAR VIEW

HORIZONTAL SWEEP CIRCUIT ADJUSTMENTS

Turn the set on and tune in a TV station, preferably a test pattern.

(1) Set the horizontal hold control to its mid-range position.

(2) Connect a short jumper across the horizontal oscillator coil (L27).

(3) Connect the DC probe of VTVM to pin 2 (grid) of V16. Connect positive lead to chassis. Adjust horizontal range trimmer (B1) for zero volts on VTVM. If necessary, readjust horizontal hold control slightly to obtain zero reading on VTVM.

(4) Remove jumper across L27 and adjust horizontal oscillator slug (B2) for zero reading on VTVM. Switch off channel and back again. Picture should pull into sync.

Adjust the horizontal width slug (B3) for a picture that is slightly wider than necessary to fill the picture mask horizontally.

Adjust the horizontal linearity slug (B4) for a picture that is symmetrical from left to right.

AGC CONTROL ADJUSTMENT

Permit the receiver to warm-up for at least five minutes and tune in the strongest signal in the area. Rotate the AGC control clockwise until the picture begins to overload, or if the signal is weak, to the point where "snow" is more pronounced in the picture. Then rotate the control counter clockwise until the "snow" is at minimum with the best picture, or no sign of overload is visible.

It is suggested this control be set on the strongest signal within the area so overloading will not occur when switching from channel to channel.

TROUBLE SHOOTING AIDS

SWEEP

HORIZONTAL

LOSS OF SWEEP

Follow procedure outlined under "Loss of High Voltage".

INSUFFICIENT SWEEP

Check adjustments B3 and B4. Check by substitution V17, V18, V20 and V21. Check R110, R111, T2, T4A, C89 and other associated components.

DRIVE LINES

Check by substitution V17 and V18. Check adjustments B3 and B4. Check T2, T4A, C88, R106 and other associated components.

COMPRESSED LEFT SIDE

Check by substitution V17 and V18. Check adjustments B3 and B4. Check horizontal output and damper stages for component failure or change of value.

FOLDS

Follow procedure outlined under "Drive Lines".

PIE CRUST EFFECT

Check by substitution V16, V17 and V18. Check C81 for open. Check L27 and other associated components.

XMAS TREE EFFECT

Check by substitution V16, V17 and V18. Check L27, C84, C86, R98, R106, C88, T2, T4A and other associated components.

VERTICAL

LOSS OF SWEEP

Check by substitution V14 and V13. Check waveform W9.

If Satisfactory	If Unsatisfactory
Check T3, T4B, R87 and other associated components.	Check C73, C70, R83, R84, R8 and other associated components.

INSUFFICIENT SWEEP

Check by substitution V14 and V13. Check height and vertical linearity controls for proper operation. Check T3, T4B and other associated components.

COMPRESSED AT BOTTOM

Check by substitution V14 and V13. Check R8, R84, C2B and other associated components.

COMPRESSED AT TOP

Check by substitution V14 and V13. Check R7, C2C, C73, and other associated components.

FOLDS

Check by substitution V14 and V13. Check C70, R82, R3 and other associated components.

SYNC

LOSS OF VERTICAL AND HORIZONTAL SYNC

Check by substitution V11 and V12. Check R64, ,R65, R66, R71, R72, C64, C63, C66 and other associated components.

LOSS OF VERTICAL SYNC-HORIZONTAL SYNC SATISFACTORY

Check by substitution V14. Check waveform W7.

If Satisfactory	If Unsatisfactory
Check R81, R82, C70, R3, and other associated components.	Check vertical integrator network for component failure or change of value. Check video IF alignment for overloading.

LOSS OF HORIZONTAL SYNC -VERTICAL SYNC SATISFACTORY

Check by substitution V15 and V16. Check waveform W14.

If Satisfactory	If Unsatisfactory
Check C83, C86, R102, R2, and other associated components.	Check horizontal AFC network for component failure or change of value.

HORIZONTAL BENDING

Check by substitution V7, V11, V12 and V15. Check horizontal AFC network.

VIDEO

LOSS OF VIDEO

Substitute V6. Check L14, L17, C41, C42, L18, picture tube and other associated components.

SOUND BARS (4.5MC BEAT)

Adjust tuner fine tuning for best sound and picture. Check adjustment A11. If still unsatisfactory, check video IF alignment.

POOR CONTRAST

Substitute V6. Check video detector network. Check picture tube and other associated components.

NEGATIVE PICTURE

Substitute V6. Check L14, L17, L18, R45, R43, C41, C42, picture tube and other associated components.

SMEAR

Substitute V6. Check components associated with V6. Check video detector network. Check video IF alignment.

WIDE BLACK BAR ACROSS PICTURE

Check by substitution V1, V3, V4, V5 and V6 for heater to cathode leakage.

AUDIO

WEAK OR NO SOUND

Check by substitution V8, V9, and V10. Check stages V10 using audio signal generator. Apply audio signal across R18.

If Satisfactory	If Unsatisfactory
Check audio detector and audio IF stages for component failure or change of value. Check audio IF alignment.	Check C60, C2A, R61, R60, T7, speaker and other associated components.

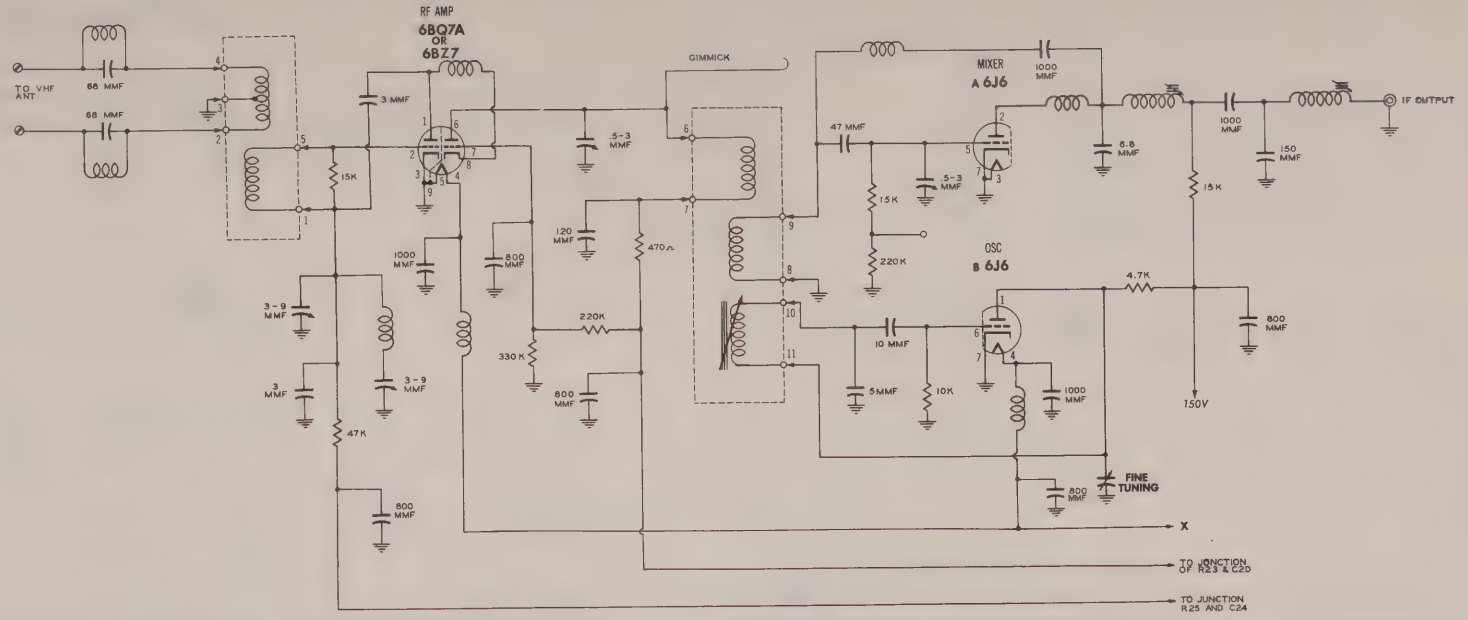
BUZZ

Adjust tuner fine tuning for best sound and picture. Check adjustments R6 and A12 for minimum buzz. If still unsatisfactory, check Audio IF alignment.

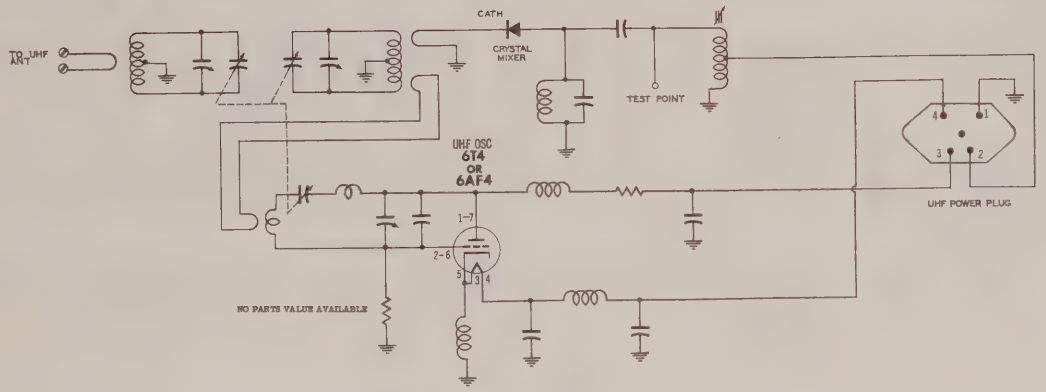
DISTORTED

Follow procedure outlined under "Weak or No Sound".

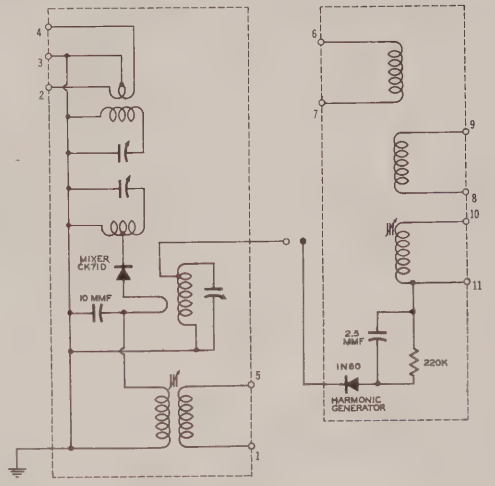
WESTINGHOUSE MODELS H-769T21, H-769TU21, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-787K21, H-787KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-830K21, H-830KU21, H-831K21, H-831KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-836T21, H-836TU21, H-838K21, H-838KU21, H-839K21, H-839KU21 (Ch. V-2263-11, -12, -13, -14, -15, -22, -35, V-2273-111, -122, -124, -132, -134, -222, -322)



UHF-VHF TUNER PART NO. V-12415-1 USED ON CHASSIS V-2263-14



UHF TUNER PART NO. 12390-1 USED ON CHASSIS V-2263-13,-12; AND V-2273-122,-124,-132,-134



UHF STRIPS USED WITH UHF-VHF TUNER V-12415-1

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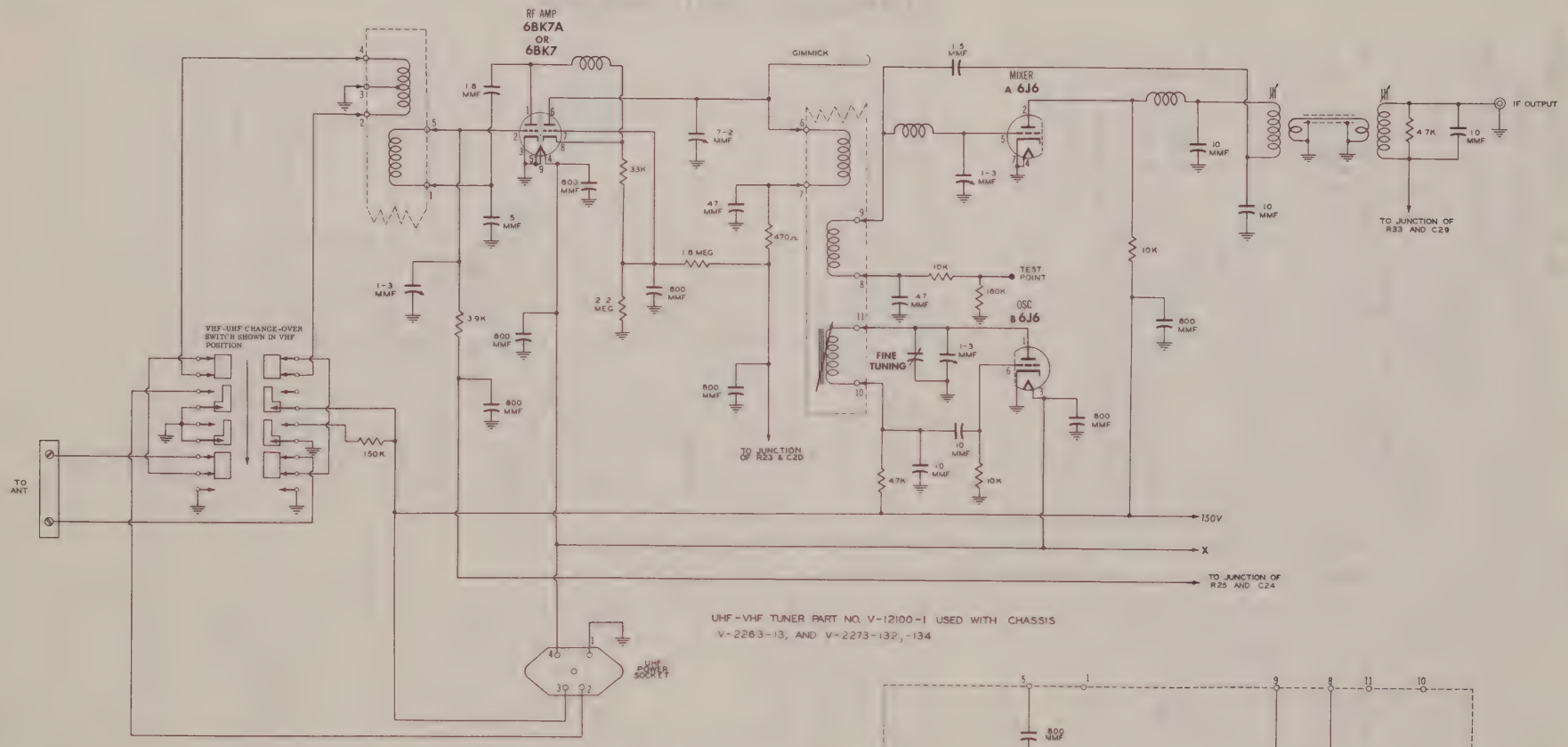
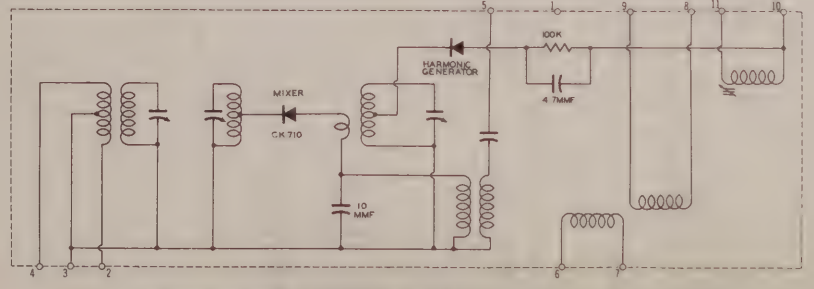
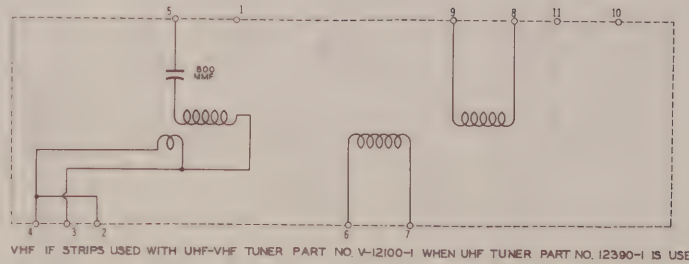
UHF-VHF TUNER- SCHEMATIC



UHF-VHF TUNER PART NO. V-12100-1 USED WITH CHASSIS V-2263-13, AND V-2273-132, -134



UHF STRIP USED WITH UHF-VHF TUNER PART NO. V-12100-1



VHF IF STRIPS USED WITH UHF-VHF TUNER PART NO. V-12100-1 WHEN UHF TUNER PART NO. 12390-1 IS USED

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UHF-VHF TUNER- SCHEMATIC

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L. F. BLANKENSHIP
DENVER

PARTS LIST AND DESCRIPTIONS

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA: Westinghouse PART No.	REPLACEMENT DATA: STANDARD REPLACEMENT	RETMA BASE TYPE	NOTES
V1	RF Amplifier	6BZ7	6BZ7	9AJ	
V2	Converter	6U8	6U8	9AE	
V3	1st. Video IF Amp.	6CB6	6CB6	7CM	
V4	2nd. Video IF Amp.	6CB6	6CB6	7CM	
V5	3rd. Video IF Amp.	6CB6	6CB6	7CM	
V6	Video Output	12BY7	12BY7	9BF	
V7	AGC Keying	6AU6	6AU6	7BK	
V8	Sound IF Amp.	6AU6	6AU6	7BK	
V9	Audio Detector	6BN6	6BN6	7DF	
V10	Audio Output	6BK5	6BK5	9BQ	
V11	Sync Limiter-Syn Amp.	12AT7	12AT7	9A	
V12	Sync Separator	6AU6	6AU6	7BK	
V13	Noise Limiter-Vert. Output	12BH7	12BH7	9A	
V14	Vert. Mult.	6SN7GT	6SN7GT	8BD	
V15	Horiz. AFC	6AL5	6AL5	6BT	
V16	Horiz. Mult.	12AU7	12AU7	9A	
V17	Horiz. Output	6BQ6GT	6BQ6GT	6AM	
V18	Damper	6AX4GT	6AX4GT	4CG	
V19	HV Rectifier	1B3GT	1B3GT	3C	
V20	LV Rectifier	5U4G	5U4G	5T	
V21	LV Rectifier	5U4G	5U4G	5T	

CATHODE-RAY TUBE

ITEM No.	REPLACEMENT DATA: Westinghouse PART No.	CBS-HYTRON PART No.	GENERAL ELECTRIC PART No.	SYLVANIA PART No.	WESTINGHOUSE PART No.	RETMA BASE TYPE	NOTES
V22	21YP4 21YP4A ①	21YP4 12YP4A ②	21YP4 21YP4A ②	21YP4 21YP4A ①	21YP4	12L 12L	① Used in models H-836T21, H-836TU21 ② Aluminized

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING: CAP.	RATING: VOLT	REPLACEMENT DATA: Westinghouse PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C1A	▲40	450	V-9891-1	AFH4-93		D092		FP428.4	TVL-4720	
B	■40	450								
C	▲30	350								
D	30	350								
C2A	30	50	V-11535-1	E4D584		D113			R1488	
B	▲30	500								
C	▲150	50								
D	■10	450								
C3	.5-3				829-3		3115-01-0R5	CT565A		
C4	1000		V-8662	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C5	3		V-8659	SI3NP0	TCZ-3	Z007	NP0K-030	ZT-5533	5TCCB-V33	
C6	800									
C7	.5-3				829-3		3115-01-0R5	CT565A		
C8	1.5		V-8749	SI1.5NP0	TCZ-1.5	Z004	NP0K-1R5	ZT-5515	5TCCB-V15	
C9	47		V-8661	BPD-000047	D6-470	G033	GP1K-470	UC-5447	5GA-Q47	
C10	800									
C11	47		V-8755							
C12	.5-3				829-3		3115-01-0R5	CT565A		
C13	5		V-8756							
C14	10		V-8746							
C15	.5-3				829-3		3115-01-0R5	CT565A		
C16	1000		V-8662	BPD-001	DD-102	K069	801-001	DC-521	5HK-D1	
C17	800									
C18	220		V-8748	BPD-00022	D6-221	G051	GP2K-221	UC-5322	5GA-T22	
C19	10									
C20	800									
C21	5000		V-5596	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C22	.02	600	RCP10M6203M	P688-02	DF-203	CUB6S2	817-02	PT612	6TM-S2	
C23	5000		V-5596-1	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C24	.05	400	RCP10W4503M	P488-05	DF-503	CUB4S5		PT415	4TM-S5	Note 1
C25	2.2		V-5658-14	SI2.2NP0	TCZ-2.2	TZ05	NP0K-2R2			
C26	68		R1CC20S2L680K	SI68	D6-680	TP32	GP1K-680	UC-5468	5GA-Q68	
C27	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C28	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C29	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C30	2.2		V-5658-2	SI2.2NP0	TCZ-2.2	TZ05	NP0K-2R2			
C31	47		R1CC20S2L470K	SI47	D6-470	TP29	GP1K-470	UC-5447	5GA-Q47	
C32	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C33	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C34	5000		V-5596	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C35	.47		V-5658-11			TZ01	NP0K-R47			
C36	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C37	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C38	800		V-9863-1	BPD-0008	DD-801	K069	801-001	DC-521	5HK-D1	
C39	470	500	RCM20B471K	1469-0005		5R5T47		MCB245	MS-35	
C40	6.8		V-5658-12	SI6.8NP0	TCZ-6.8	TZ08	NP0K-6R8	ZT-5568	5TCCB-V68	
C41	56	500	RCM20B560K			22R5Q56				
C42	.1	400	RCP10M4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C43	.25	400	RCP10W4254	P488-25		CUB4P25		PT4025	4TM-P25	
C44	.02	600	RCP10M6203M	P688-02	DF-203	CUB6S2	817-02	817-02	6TM-S2	
C45	5000		V-5596-1	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C46	.25	400	RCP10W4254M	P488-25		CUB4P25		PT4025	4TM-P25	
C47	.1	400	RCP10W4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C48	4.7		V-9926-3	SI5NP0	TCZ-4.7	TZ07	NP0K-050	ZT-555	5TCCB-V47	
C49	150	500	RCM20B151K	1469-00015		22R5T15		MCB236		
C50A	5000		V-9044-1	BPD-2X0047	DD3-502	DK079	811-005	DC-525	5HK-2D47	
B	5000						811-005	DC-525		
C51	5000		V-5596-1	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C52	47	500	RCM20B470K	1469-00005		22R5Q47		MCB225	MS-45	
C53	5000		V-5596	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C54	47		V-10710-1	BPD-000047	D6-470	G033	801-470	UC-5447	5GA-Q47	
C55A	5000		V-9044-1	BPD-2X0047	DD3-502	DK079	811-005	DC-525	5HK-2D47	
B	5000						811-005	DC-525		

WESTINGHOUSE MODELS H-769T21, H-769TU21, H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-787K21, H-787KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-830K21, H-830KU21, H-831K21, H-831KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-836T21, H-836TU21, H-838K21, H-838KU21, H-839K21, H-839KU21, (Ch. V-2263-11, -12, -13, -14, -15, -22, -35, V-2273-11, -122, -124, -132, -134, -222, -322)

PROPERTY OF
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3924 MEADE ST.
DENVER, COLORADO

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING CAP.	RATING VOLT	Westinghouse PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C56	1500		R2CC62Y5Y152P	BPD-0015	DD-152	K071	801-0015	DC-5215	5HK-D15	
C57	5000		V-5596-1	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C58	.02	600	RCP10M6203M	P688-03	DF-203	CUB6S3	817-03	DT612	6TM-S2	
C59	.01	600	RCP10M6103M	P688-01	D6-103	CUB6S1	GP2-333-103	PT611	6TM-S1	
C60	.005	600	RCP10M6502M	P688-005	D6-502	CUB6D5	GP2-333-502	PT625	6TM-D5	
C61	5000		V-5596-1	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C62	.1	400	RCP10W4104M	P688-1	DF-104	CUB4P1		PT401	4TM-P1	
C63	.01	400	RCP10M6103M	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C64	270	500	RCM02B271K	1469-0003		22R5T27		MCB241	MS-33	
C65	270	500	RCM03B271K	1469-0003		22R5T27		MCB241	MS-33	
C66	.1	400	RCP10W4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C67	47	500	RCM20B470K	1469-00005		22R5Q47		MCB225	MS-45	Note 2
C68A	.01					CUB6S1	GP2-333-103	PT611		
B	.002		♦V-11192-1	♦PA-111	♦PC-101	CUB6D2	GP2-333-502	PT625	♦V-2	
C	.005					CUB6D5	GP2-333-502	PT625		
D	.005					CUB6D5	GP2-333-502	PT625		
C69	.05	400	RCP10W4503M	P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C70	.01	600	RCP10M6103K	P688-01	D6-103	CUB6S1	GP2-333-103	PT611	6TM-S1	
C71	.05	400	RCP10W4503K	P488-05	DF-503	CUB4S5		PT415	4TM-S5	
C72	.1	400	RCP10W4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C73	.1	600	RCP10M6104M	P688-1	DF-104	CUB6P1		PT601	6TM-P1	
C74	5000		V-5596-1	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C75	150	500	RCM20B151K	1469-0005		22R5T15		MCB235	MS-31	
C76	100	500	RCM20B101K	1469-0001		22R5T1		MCB235	MS-31	
C77	680	500	RCM20B681K	1479-0007		5R5T68				
C78	390	500	RCM20B391K	1469-0004		5R5T39		MCB243	MS-34	
C79	.01	400	RCP10M6103M	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C80	.005	600	RCP10M6502M	P688-005	D6-502	CUB6D5	GP2-333-502	PT625	6TM-D5	
C81	.01	600	RCP10M6103M	P688-01	D6-103	CUB6S1	GP2-333-103	PT611	6TM-S1	
C82	.1	400	RCP10W4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C83	100	500	RCM20B101K	1469-0001		22R5T1		MCB235	MS-31	Note 2
C84	3900	500	RCM30C392K	1464-004		1R5D39		MCB463	MS-24	
C85	.1	400	RCP10W4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C86	100	500	RCM20B101K	1469-0001		22R5T1		MCB235	MS-31	
C87	.1	400	RCP10W4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	Note 2
C88	390	500	RCM20B391K	1469-0004		5R5T39		MCB243	MS-34	
C89	.25	400	RCP10W4254M	P488-25		CUB4P25		PT4025	4TM-P25	
C90	.01	600	RCP10M6103M	P688-01	D6-103	CUB6S1	GP2-333-103	PT611	6TM-S1	
C91	.1	600	RCP10M6104M	P688-1	DF-104	CUB6P1		PT601	6TM-P1	
C92	.1	400	RCP10W4104M	P488-1	DF-104	CUB4P1		PT401	4TM-P1	
C93	.04	400	RCP10M4403M	P688-04		CUB6S4		PT614	6TM-S4	
C94	5000		V-5596-1	BPD-005	DD-502	K080	811-005	DC-525	5HK-D5	
C95	500	20000	V-9901-3	HV20C	TV3-503	MMU20TS	413	HV20035A	20DX-T5	Note 2
C96	.25	400	RCP10M4254M	P488-25		CUB4P25		PT4025	4TM-P25	
C97	.09	400	RCP10M4603M	P688-06		CUB6S6		PT616	6TM-S6	
C98	43		V-9792-1043GJ							Note 3
C99	.01	600	V-5040-15	8892X-01		CUB6S1		PT611	6TM-S1	
C100	.01	600	V-5040-15	8892X-01		CUB6S1		PT611	6TM-S1	Note 2
C101	.005	600	RCP10M6502M	P688-005	D6-502	CUB6D5	GP2-333-502	PT625	6TM-D5	Note 4

Note 1. Some models use .01MFD in this application (part number RCP10M6103M).
Note 2. Not used in all models.
Note 3. Some models use 51MMF in this application (part number V-9792-1051GJ).
Note 4. Used in Ch. V-2263-22 and V-2273-222.
♦ Items C68A, C68B, C68C, C68D, R77A, R77B, R77C, R77D are combined in one unit.

CONTROLS

ITEM No.	RATING RESISTANCE	RATING WATTS	REPLACEMENT DATA Westinghouse PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	1500Ω	½	V-9877M-7	* QJ-519	RTV-455			Contrast-Panel
B	500KΩ	½						Volume & switch-tapped ④
								45KΩ-Rear
R2	60KΩ	½	V-11536-3	Q11-125			U-41	Horiz. Hold
R3A	750KΩ	½	V-11539-2	Q11-138	A47-1Meg-S	AB-89	U-54	Vert. Hold
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R3A
R4A	100KΩ	½	V-11536D-2	Q11-128	A47-100K-S	AB-40	U-41	Brightness
B	Shaft		Not Req.	Not Req.	KSS-3	AK-4	Not Req.	Attach to R4A
R5	1 Meg	½	V-12372-1	Q11-136				AGC
R6	500Ω	1	V-11345-2		39-500			Buzz - wire wound
R7A	5000Ω	½	V-8463	Q11-114	A47-5000-S	AB-10	SU-14	Vert. Linearity
B	Shaft		Not Req.	Not Req.	FKS-1/4	AK-1	Not Req.	Attach to R7A
R8A	250KΩ	½	V-9813-4	Q11-130	A47-250K-S	AB-50	U-48	Height
B	Shaft		Not Req.	Not Req.	FKS-1/4	AK-1	Not Req.	Attach to R8A
R9A	2 Meg	½	V-9894E-2	Q11-139	A47-2Meg-S	AB-75	SU-58	Focus
B	Shaft		Not Req.	Not Req.	KSS-3	AK-1	Not Req.	Attach to R9A
R10	1 Meg	½						Tone-Note

* CONCENTRIKIT EQUIVALENT KIT K-2 BASE ELEMENTS & SHAFTS B17-109 & P1-310 (Panel)
B18-133X & R2-329 (Rear) & SWITCH 76-1.
Note- Used in chassis No. V-2263-22 only.

RESISTORS

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Westinghouse PART No.	IRC PART No.	NOTES
R11	22KΩ	½		BTS-22K	
R12	47KΩ	½		BTS-47K	
R13	820KΩ	½		BTS-820K	
R14	470KΩ	1		BTA-470K	
R15	1500Ω	1		BTA-1500	
R16	6800Ω	½		BTS-6800	
R17	100KΩ	½		BTS-100K	
R18	100KΩ	½		BTS-100K	
R19	100KΩ	½		BTS-100K	
R20	82000Ω	½		BTS-8200	
R21	10KΩ	½		BTS-10K	
R22	3300Ω	1		BTA-3300	
R23	3900Ω	2	RC40A3392K	BTS-3900	
R24	18 Meg	½	RC20AE186J	BTS-18 Meg	
R25	1.5 Meg	½	RC20AE155J	BTS-1.5Meg	
R26	390KΩ	½	RC20AE394K	BTS-390K	
R27	10KΩ	½	V-9927-10	BTS-10K	

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Westinghouse PART No.	IRC PART No.	NOTES
R28	10Ω	½	RC20AE100K	BTS-10	
R29	68Ω	½	RC20AE680K	BTS-68	
R30	470Ω	½	RC20AE471M	BTS-470	
R31	4700Ω 5%	½	V-9927-2	BTS-4700 5%	
R32	10KΩ	1	RC20AE103M	BTS-10K	
R33	100KΩ 5%	½	RC20AE104K	BTS-100K 5%	
R34	68Ω	½	RC20AE680M	BTS-68	
R35	470Ω	½	RC20AE471M	BTS-470	
R36	4700Ω 5%	½	V-9927-2	BTS-4700 5%	
R37	150Ω	½	RC20AE151K	BTS-150	
R38	470Ω	½	RC20AE471M	BTS-470	
R39	220Ω	½	RC20AE221K	BTS-220	
R40	3300Ω	2	RC40A3392K	BTS-3300	
R41	12KΩ	½	RC20AE123K	BTS-12K	
R42	10Ω	½	RC20AE100K	BTS-10	
R43	8800Ω	½	RC20AE882K	BTS-8800	
R44	3900Ω	5	V-5924-3		

RESISTORS (cont)

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Westinghouse PART No.	IRC PART No.	NOTES
R45	330KΩ	½		RC20AE334K	BTS-330K
R46	330KΩ	½		RC20AE334K	BTS-330K
R47	1.5Meg	½		RC20AE155K	BTS-1.5Meg
R48	100KΩ	½		RC20AE104K	BTS-100K
R49	4700Ω	½		RC20AE472K	BTS-4700
R50	18KΩ	2		RC40AE183K	BTB-18K
R51	4700Ω	½		RC30AE472K	BTA-4700
R52	120Ω	½		RC20AE121	BTS-120
R53	1200Ω	½		RC20AE122K	BTS-1200
R54	27KΩ	2		RC40AE273K	BTB-27K
R55	470Ω	½		RC20AE471M	BTS-470
R56	330KΩ	½		RC20AE334K	BTS-330K
R57	12KΩ	½		RC20AE123K	BTS-12K
R58	10KΩ	½		RC20AE103M	BTS-10K
R59	150Ω	½		RC20AE151M	BTS-150
R60	180Ω	½		RC20AE181K	BTS-180
R61	1000Ω	½		RC20AE102K	BTS-1000
R62	560Ω	2		RC40AE561K	BTB-560
R63	330KΩ	½		RC20AE334K	BTS-330K
R64	220KΩ	½		RC20AE224K	BTS-220K
R65	270KΩ	½		RC20AE274K	BTS-270K
R66	2200Ω	½		RC20AE222K	BTS-2200
R67	47000Ω	½		RC20AE473M	BTS-4700
R68	470KΩ	½		RC20AE474K	BTS-470K
R69	470KΩ	½		RC20AE474K	BTS-470K
R70	220KΩ	½		RC20AE224K	BTS-220K
R71	390KΩ	½		RC20AE394K	BTS-390K
R72	47KΩ	½		RC20AE473K	BTS-47K
R73	1 Meg	½		RC20AE105K	BTS-1 Meg
R74	1200Ω	½		RC20AE122K	BTS-1200
R75	27KΩ	½		RC20AE273K	BTS-27K
R76	39000	½			BTS-3900
R77A	22KΩ	½			BTS-22K
B	22KΩ	½			BTS-22K
C	8200Ω	½		♦ V-11192-1	BTS-8200
D	8200Ω	½			BTS-8200
R78	1200Ω	½		RC20AE122K	BTS-1200
R79	10KΩ	½		RC20AE103K	BTS-10K
R80	47Ω	½		RC20AE470K	BTS-47
R81	100KΩ	1		RC30AE104K	BTA-100K

ITEM No.	RATING OHMS	RATING WATT	REPLACEMENT DATA Westinghouse PART No.	IRC PART No.	NOTES
R82	560KΩ	½		RC20AE564K	BTS-560K
R83	100KΩ	½		RC20AE104K	BTS-100K
R84	39KΩ	½		RC20AE393K	BTS-39K
R85	2.2Meg	½		RC20AE225K	BTS-2.2Meg
R86	1000Ω	½		RC20AE102K	BTS-1000
R87	7500Ω	4		V-12171-3	
R88	6800Ω	½		RC20AE682K	BTS-6800
R89	3300Ω	½		RC20AE332K	BTS-3300
R90	560Ω	½		RC20AE561K	BTS-560
R91	560Ω	½		RC20AE561K	BTS-560
R92	390Ω	½		RC20AE391K	BTS-390
R93	33KΩ	½		RC20AE333K	BTS-33K
R94	1 Meg	½		RC20AE105K	BTS-1 Meg
R95	1 Meg	½		RC20AE105M	BTS-1 Meg
R96	220KΩ	½		RC20AE224K	BTS-220K
R97	470KΩ	½		RC20AE474K	BTS-470K
R98	820Ω	½		RC20AE821K	BTS-820
R99	27KΩ	½		RC20AE273K	BTS-27K
R100	22KΩ	½		RC20AE223K	BTS-22K
R101	27KΩ	½		RC20AE273K	BTS-27K
R102	270KΩ 5%	½		RC20AE274J	BTS-270K 5%
R103	18KΩ	½		RC20AE183K	BTS-18K
R104	56KΩ	½		RC20AE563K	BTS-56K
R105	10KΩ	½		RC20AE103K	BTS-10K
R106	5600Ω	½		RC20AE562K	BTS-5600
R107	470KΩ	½		RC20AE474K	BTS-470K
R108	150Ω	½		RC20AE151M	BTS-150
R109	33Ω	1		RC30AE330K	
R110	15KΩ	2		RC40AE153K	BTB-15K
R111	18KΩ	2		RC40AE183K	BTB-18K
R112	1000Ω	½		RC20AE102K	BTS-1000
R113	100KΩ	1		RC30AE104K	BTA-100K
R114A	18000	30			
B	390Ω	1			
R115	220KΩ	1		RC30AE224M	BTA-220K
R116	50Ω	10		V-11338-5	
R117	900Ω	25		V-11338-3	
R118	600Ω	25		V-11229-3	
R119	47KΩ	½			BTS-47K

Note 1. Some models may use a 6800Ω resistor in this application.
Note 2. Some models may use a 330KΩ resistor in this application.
Note 3. Some models may use a single resistor in this application.
Note 4. Used in chassis No. V-2263-22 or V-2273-222 only.
♦ Items R77A, R77B, R77C, R77D, C68A, C68B, C68C, C68D are combined in one unit.

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	RATING SEC. 1	RATING SEC. 2	REPLACEMENT DATA Westinghouse PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	RCA TYPE No.	Holldorson PART No.	Thordarson PART No.
T1	117VAC	510VCT	5VAC	V-12605A-1	P-8167 ④		R-61BC① ②		P9739 ③	
	④ 1.82A	.260ADC	④ 6A							
	SEC. 3	SEC. 4	SEC. 5							
	12. 6VCT									
	④ 4.8A									

① Parallel and phase 6.3V 6A windings for Sec. # 3.
② Tape 6.3V 1.2A winding.
③ Parallel and phase 6.3V 4A, and 8A windings for Sec. # 3.
④ Drill new mounting holes.

TRANSFORMERS (SWEEP CIRCUITS)

ITEM No	USE	REPLACEMENT DATA Westinghouse PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	RCA TYPE No.	Holldorson PART No.	Thordarson PART No.
T2	Horiz. Output Trans.	V-11548-3	A-8236 *	HVO-9 & MWC-1 ①	D-35 *	232T1 *	FB41 & RF800 ①	
T3	Vert. Output Trans.	V-10909-2	A-8141	A-3039	A-104X	226T1	Z1806	26S4
T4A	Yoke-Horiz.(30MH)	V-12218-2	DY-11A ⑤	MDF-73 ③	Y-22-1 ⑤	222D1 ③	DF605 ③	Y-10 ③
B	Vert.(58MH)	V-12218-1 ②						
T5	Horiz.Lin. Coil (1.5-9MH)	V-11789-1	WC-8 ④	MWC-6 ④	WC-12 ④⑤	213R1 ④	RF800 ④⑥	WC-18 ④
T6	Width Coil (3-5.5MH)	V-11791-1	WC-8 ④ ⑦	MWC-6 ④	WC-13 ④⑤	211R1 ④		WC-17 ④ ⑦

① Drill new mounting holes.
② Alternate deflection yoke.
③ Use original yoke cover and positioning device .
④ Drill new mounting hole or use original slider and core.
⑤ Connect to coded blue and green terminals.
⑥ Connect to terminals 3 and 4.
⑦ Do not use tap.

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA

Use Original Width Coil Unless Replacement Type Is Listed

ORIGINAL TERMINAL CONNECTIONS	Stancor Replacement Connections	Merit Replacement Connections	Triad Replacement Connections	RCA Replacement Connections	Holldorson Replacement Connections	Thordarson Replacement Connections
3	3	Hi-Volt Rect Plate Lead	Hi-Volt Rect Plate Lead	Hi-Volt Rect Plate Lead	Hi-Volt Rect Plate Lead	
2	2	9	10	10	9	
4	4	7	9 & T	8	See Note ②	
8	8	3	5	4	3	

*HORIZONTAL OUTPUT TRANSFORMER CONNECTION DATA (cont)

	ORIGINAL TERMINAL CONNECTIONS	Stancor Replacement Connections	Merit Replacement Connections	Triad Replacement Connections	RCA Replacement Connections	Holldorson Replacement Connections	Thordarson Replacement Connections
	7	7	1	3	3	1	
	5	5	MWC- 1 (Blue Term)	2	1	RF800 (Term #1)	
	6	6	MWC-1 (Red Term)	1	2	RF800 (Term. #2)	
Connect Width Coil Across →	8 & 7	8 & 7	MWC-, (orange & black terms) 3 & 1	3 & 5	4 & 3	RF800 (Terms #3 & #4) 3 & 1	
Special Notes →		②				① ②	

① If AGC does not function properly, reverse secondary connections to width coil.
② Connect damper cathode (clear lead) to terminal #6, connect yoke (red lead) to terminal #5.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	IMPEDANCE SEC.	REPLACEMENT DATA Westinghouse PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Holldorson PART No.	Thordarson PART No.	NOTES
T7	7.2KΩ	3.3Ω	V-14080-2	A-3678 ①	A-2931 ①	S-7X ①	21113 ①	26S48 ①	① Drill one new mounting hole. ② Alternate audio output transformer.
			V-9238-2 ②						

SPEAKER

ITEM No.	RATINGS SIZE	RATINGS FIELD	RATINGS V. C. IMP.	REPLACEMENT DATA Westinghouse PART No.	VIKING PART No.	QUAM PART No.	NOTES
SP1	5 1/4"	PM	3.3Ω	V-10030-1	525J4	52A1	① Alternate 5 1/4" PM speaker.
	10"	PM	3.3Ω	V-12127-1 ①			
	6"	PM	3.3Ω	V-9770-1 ②	10J11	10A21	② Used in models H-786K21, H-786KU21, H-787K21, H-787KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-834K21, H-834KU21, H-835K21, H-835KU21
				V-12143-1 ③	6J4	6A1	③ Used in Models H-836K21, H-836KU21, H-839K21 and H-839KU21

COILS (RF-IF)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA Westinghouse PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L1A	Ant. Coil	0ΩCT	0Ω	V-14176-2				Channel 2
B	Ant. Coil	0ΩCT	0Ω	V-14176-3				Channel 3
C	Ant. Coil	0ΩCT	0Ω	V-14176-4				Channel 4
D	Ant. Coil	0ΩCT	0Ω	V-14176-5				Channel 5
E	Ant. Coil	0ΩCT	0Ω	V-14176-6				Channel 6
F	Ant. Coil	0ΩCT	0Ω	V-14176-7				Channel 7
G	Ant. Coil	0ΩCT	0Ω	V-14176-8				Channel 8
H	Ant. Coil	0ΩCT	0Ω	V-14176-9				Channel 9
I	Ant. Coil	0ΩCT	0Ω	V-14176-10				Channel 10
J	Ant. Coil	0ΩCT	0Ω	V-14176-11				Channel 11
K	Ant. Coil	0ΩCT	0Ω	V-14176-12				Channel 12
L	Ant. Coil	0ΩCT	0Ω	V-14176-13				Channel 13
L2	Neutr. Coil	0Ω						
L2A	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-2				Channel 2
B	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-3				Channel 3
C	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-4				Channel 4
D	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-5				Channel 5
E	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-6				Channel 6
F	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-7				Channel 7
G	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-8				Channel 8
H	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-9				Channel 9
I	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-10				Channel 10
J	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-11				Channel 11
K	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-12				Channel 12
L	RF,Mixer Grid & Osc. Coil	0Ω		V-14177-13				Channel 13
L4	Fil. Choke							
L5	Conv. Plate	.1Ω						
L6	1st Video IF	.1Ω		V-9862-8	17-4524 *		6219 *	
L7	4.25MC Trap	0Ω		V-11973-1				
L8	Fil. Choke	0Ω		V-4886-2	19-1000		4602	L 1 Microhenries
L9	2nd Video IF	.5Ω	.4Ω	V-9879	17-4531 ■		6231	
L10	47.25MC Trap	0Ω		V-11973-1				
L11	Fil. Choke	0Ω		V-4886-2	19-1000		4602	L 1 Microhenries
L12	3rd Video IF	.5Ω	.4Ω	V-9879	17-4531 ■		6231	
L13	4th Video IF	.6Ω	.5Ω	V-12128-1				Includes crystal (CK-706), Series peaking coil, & 3 caps. (3, 6 & 12MMF)
L14	Series Peaking Coil	3.8Ω		V-9915-1	19-3093	TV-181	6177	100 Microhenries
L15	Shunt Peaking Coil	1.1Ω		V-4886-1	19-1005	TV-180	4624	14 Microhenries
L16	4.5MC Trap	1.5Ω		V-9883-9	20-1004	TV-181	1469	
L17	Series Peaking Coil	4.6Ω		V-5902-1	19-3125	TV-184	4644	140 Microhenries
L18	Series Peaking Coil	1.1Ω		V-4886-1	19-1005	TV-180	4624	14 Microhenries

WESTINGHOUSE MODELS H-769T21, H-769TU21, H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-786TK21, H-786TKU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-830K21, H-830KU21, H-831K21, H-831KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-836T21, H-836TU21, H-838K21, H-838KU21, H-839K21, H-839KU21, (Ch. V-2263-11, -12, -13, -14, -15, -22, -35, V-2273-111, -122, -124, -132, -134, -222, -322)

PARTS LIST AND DESCRIPTIONS (Continued)

COILS (cont)

ITEM No.	USE	DC RES. PRI.	DC RES. SEC.	REPLACEMENT DATA Westinghouse PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	NOTES
L19	Shunt Peaking Coil	6.8Ω		V-5902-5	19-3250	TV-185	6181	250 Microhenries
L20	1st Sound IF	.6Ω		V-9882-5	17-3400	TV-151	1470	
L21	Fil. Choke	0Ω		V-4886-2	19-1000		4602	1.1 Microhenries
L22	2nd Sound IF	1.1Ω		V-9882-2	17-3400	TV-151	1470	
L23	RF Choke	7Ω		V-9915-2	19-3300		4648	350 Microhenries
L24	Fil. Choke	0Ω		V-4886-2	19-1000		4602	1.1 Microhenries
L25	Quadrature Coil	6Ω		V-11396-1	17-1031 ▲		1470-A	
L26	Fil. Choke	0Ω		V-4886-2	19-1000		4602	1.1 Microhenries
L27	Horiz. Osc.	108Ω		V-6764	19-1576	TV-163	6210	

* Use one winding only.
■ Detune trap.
▲ Drill mounting holes.

FILTER CHOKE

ITEM No.	RATINGS TOTAL DIRECT CURRENT	RATINGS D. C. RESISTANCE	RATINGS INDUCTANCE (0 CURRENT 1000 ~)	REPLACEMENT DATA Westinghouse PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.
L28	.260A	43Ω	1.3HY	V-6471J-3	C-2326 ①	C-2996 ①	C-23X	C5037 ①	26C44

① Drill one new mounting hole.

FUSES

ITEM No.	TYPE	RATING	REPLACEMENT DATA Westinghouse PART No. FUSE	Westinghouse PART No. HOLDER	LITTELFUSE PART No. FUSE	LITTELFUSE PART No. HOLDER	BUSS PART No. FUSE	BUSS PART No. HOLDER
M1	3AG	1/4A 250V	V-6171-3	V-11966-1	312.250 (1/4A-3AG)	357001	AGC 1/4	4405

CRYSTAL DIODES

ITEM No.	ORIG. TYPE	REPLACEMENT DATA Westinghouse PART No.	SYLVANIA PART No.	FEDERAL PART No.	NOTES
M2	CK706	V-10916-1	1N60 or 1N132	1N60 or 1N64A	Video Detector

MISCELLANEOUS

ITEM No.	PART NAME	Westinghouse PART No.	NOTES
M3	Dial Light		Bayonet #47
M4	Tuner	V-12415-1	VHF - Ch. V-2263-14
	Tuner	V-12100-1	VHF- Ch. V-2263-13, V-2273-132, -134
	Tuner	V-14170-1	VHF- Ch. V-2263-15, V-2263-35
	Tuner	V-11794-1	VHF- Ch. V-2273-111, V-2263-11
	Tuner	V-12400-1	VHF- Ch. V-2273-122, -124, -322, V-2263-12, -22
	Tuner	V-12325-1	UHF - Ch. V-2273-111
	Tuner	V-12390-1	UHF- Ch. V-2273-122, -132, -322
	Tuner	V-11972-1	UHF- Ch. V-2273-124, -134
M5	Filter Assy.	V-8751	Antenna Input (VHF)
M6	Centering Device		Part of yoke cover (See T4)
M7	Ion Trap	V-9784-5	
B1	Trimmer Cap.	V-11228-2	5-80MMF (Multivibrator trimmer)
	Cabinet	V-1337-10	Mahogany (Models H-830K21, H-830KU21)
	Cabinet	V-1337-11	Blonde (Models H-831K21, H-831KU21)
	Cabinet	V-1356-1	Mahogany (Models H-834K21, H-834KU21)
	Cabinet	V-1356-2	Blonde (Models H-835K21, H-835KU21)
	Cabinet	V-1346-1	Brown (Models H-827T21, H-827TU21)
	Cabinet	V-1346-2	Mahogany (Models H-828T21, H-828TU21)
	Cabinet	V-1346-3	Gray (Models H-829T21, H-829TU21)
	Cabinet	V-1346-4	Brown (Models H-836T21, H-836TU21)
	Cabinet	V-1308-16	Models H-769T21, H-769TU21
	Cabinet	V-1358-10	Mahogany (Models H-838K21, H-838KU21)
	Cabinet	V-1358-11	Blonde (Models H-839K21, H-839KU21)
	Cabinet	V-1339-10	Mahogany (Models H-822K21, H-822KU21)
	Cabinet	V-1339-11	Blonde (Models H-823K21, H-823KU21)
	Cabinet	V-1320-1	Mahogany (Models H-786K21, H-786KU21)
	Cabinet	V-1320-2	Blonde (Models H-787K21, H-787KU21)
	Cabinet	V-1309-10	Mahogany (Models H-770T21A, H-770TU21A)
	Cabinet	V-1309-11	Blonde (Models H-771T21A, H-771TU21A)
	Mask	V-11865-1	Models H-830K21, H-830KU21, H-831K21, H-831KU21, H-831KU21, H-786K21, H-786KU21, H-787K21, H-787KU21
	Mask	V-12487-1	Models H-828T21, H-828TU21, H-829T21, H-829TU21
	Mask	V-12487-2	Models H-827T21, H-827TU21
	Mask	V-11865-4	Models H-838K21, H-838KU21, H-839K21, H-839KU21
	Mask	V-11865-3	Models H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-834K21, H-834KU21, H-835K21, H-835KU21, H-822K21, H-822KU21, H-823K21, H-823KU21
	Mask	V-12487-3	Models H-836T21, H-836TU21
	Mask	V-11909-1	Models H-769T21, H-769TU21
	Safety Glass	V-11918-1	Models H-830K21, H-839KU21, H-831K21, H-831KU21, H-838K21, H-838KU21, H-839K21, H-839KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-787K21, H-878KU21
	Safety Glass	V-12647-1	Models H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-836T21, H-836TU21
	Safety Glass	V-12036-1	Models H-769T21, H-769TU21

PROPERTY OF
L. F. BLANCHARD
3824 MEADE ST.
DENVER, COLORADO

VHF TUNER-SCHEMATIC

VHF TUNER PART NO. V-12400-1 USED WITH CHASSIS V-2263-12, AND V-2273-122, -124

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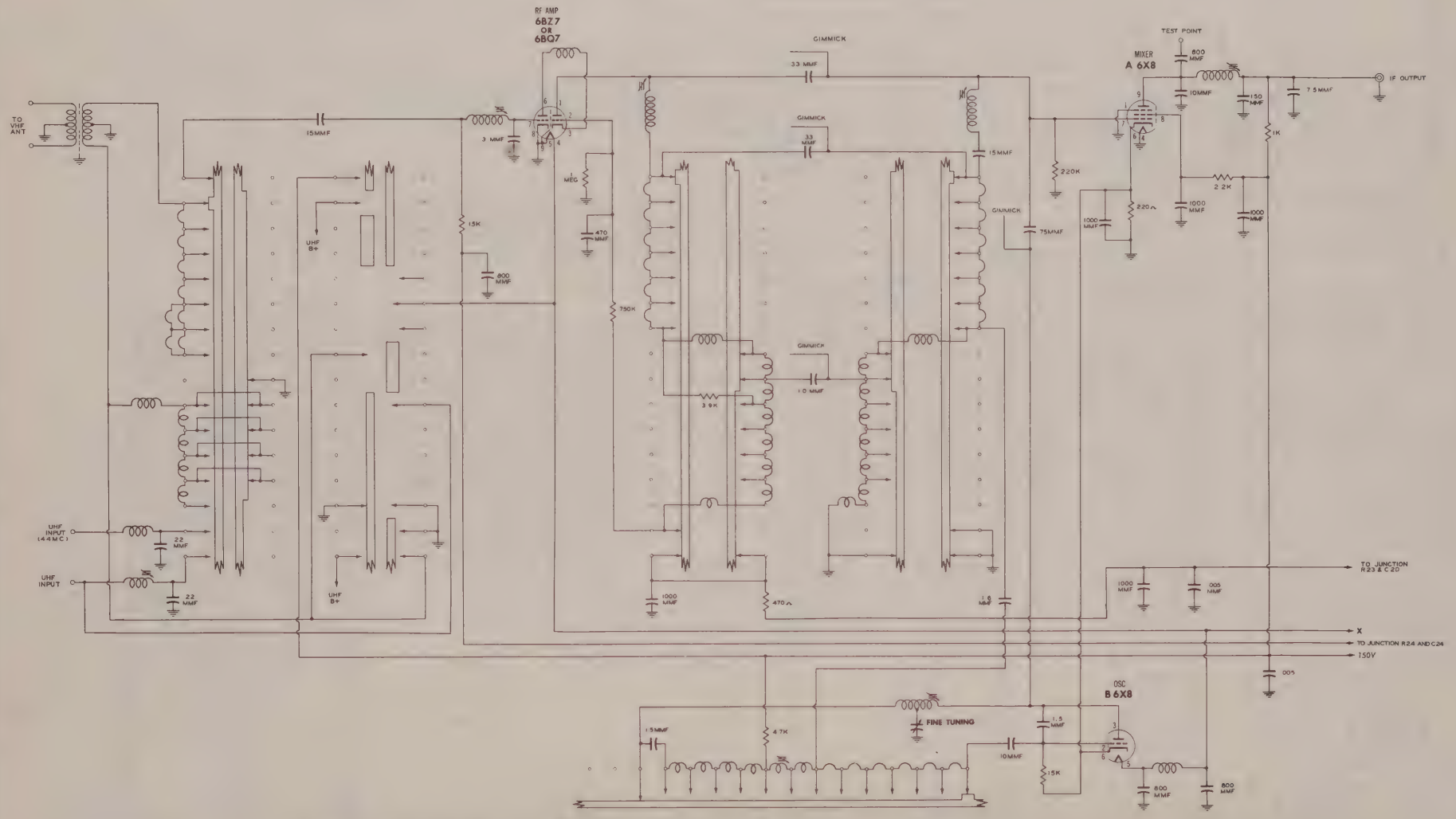

VHF TUNER PART NO. V-11794-1
USED WITH CHASSIS V-2263-11, AND V-2273-11

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CHANNEL SELECTOR SWITCH SHOWN IN CHANNEL 13 POSITION

VHF TUNER- SCHEMATIC

TROUBLE SHOOTING AIDS (cont)

PROPERTY OF
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DENVER, COLORADO

POWER

DEAD SET

If filaments fail to light, check AC interlock assembly. Check switch on volume control. Check T1. If filaments light, check V20 and V21. Check B+ filter and decoupling network.

SMALL AND/OR DIM PICTURE

Check by substitution V20 and V21. Check B+ filter and decoupling network.

HIGH VOLTAGE

LOSS OF HIGH VOLTAGE

Check by substitution V16, V17, V18 and V19. Check waveform W16.

If Satisfactory	If Unsatisfactory
Check T2, T4A, T5, T6, C94, C93, C91, C97, C96, R110, R111 and other associated components.	Check C90, C89, C86, R104, R105, L27, C84 and other associated components.

INSUFFICIENT HIGH VOLTAGE

Check by substitution V16, V17, V18, V20 and V21. Check R110, R111, C90 and other associated components. Check B3 and B4.

BLOOMING

Check by substitution V17, V18, V19, V20 and V21. Check adjustments B3 and B4. Check components associated with horizontal output stages.

GENERAL

RASTER, SOUND, NO PICTURE

Follow procedure outlined under "Loss of Video".

RASTER, PICTURE, NO SOUND

Follow procedure outlined under "Weak or No Sound".

RASTER, NO SOUND, NO PICTURE

Check by substitution V1, V2, V3, V4, V5 and V6. Check components in video IF stages.

NO RASTER, NO SOUND

Follow procedure outlined under "Dead Set".

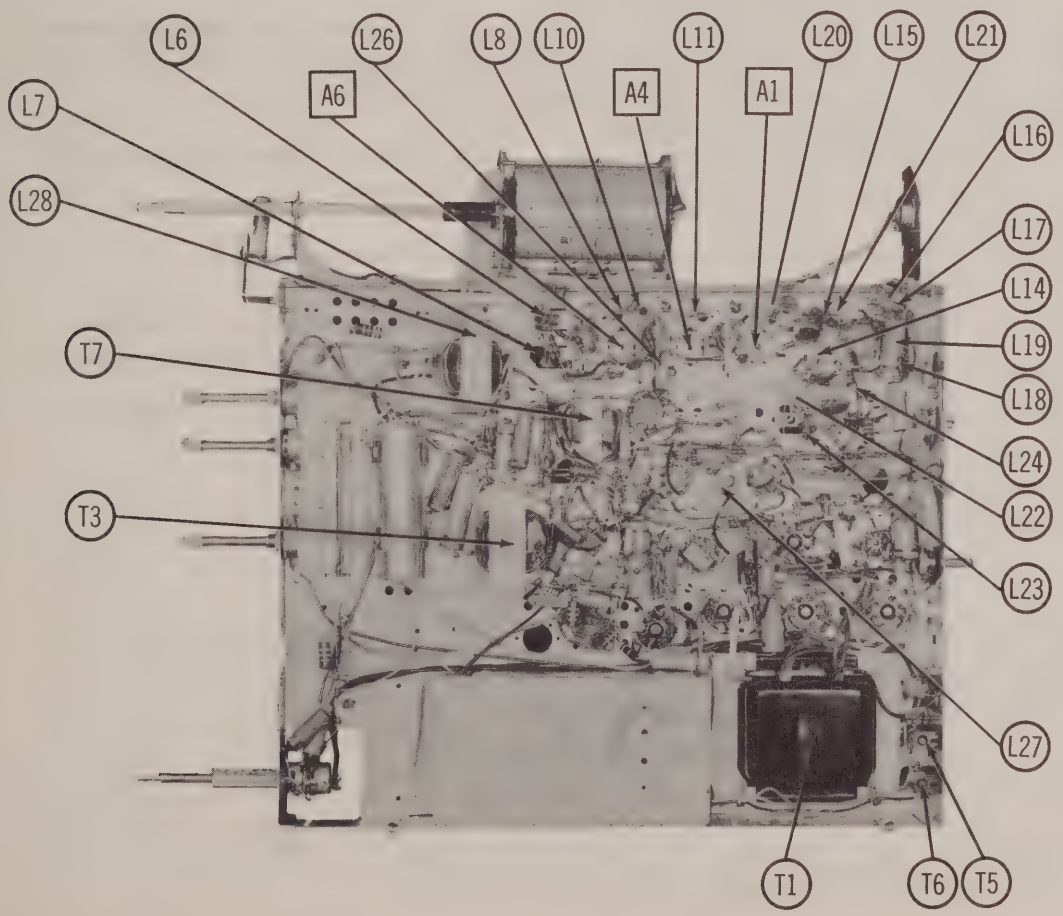
KEYSTONE EFFECT

Check T4 and its associated components.

INTERMITTENT STREAKS

Check high voltage section for corona discharge and arcing.

Symptoms shown are assumed and are not indicative of the quality and workmanship of this equipment.



CHASSIS BOTTOM VIEW-TRANS., INDUCTOR & ALIGN. IDENTIFICATION

WESTINGHOUSE MODELS H-769T21, H-769TU21, H-770T21A, H-770TU21A, H-771T21A, H-771TU21A, H-786K21, H-786KU21, H-787K21, H-787KU21, H-822K21, H-822KU21, H-823K21, H-823KU21, H-827T21, H-827TU21, H-828T21, H-828TU21, H-829T21, H-829TU21, H-830K21, H-830KU21, H-831K21, H-831KU21, H-834K21, H-834KU21, H-835K21, H-835KU21, H-836T21, H-836TU21, H-838K21, H-838KU21, H-839K21, H-839KU21, (Ch. V-2263-11, -12, -13, -14, -15, -22, -35, V-2273-11, -122, -124, -132, -134, -222, -322)

SERVICING IN THE FIELD

TUNER OSCILLATOR ADJUSTMENTS

Touch-up adjustments of the VHF Tuner Oscillator Circuit may be accomplished by removal of the Channel Selector and Fine Tuning knobs. The adjustments are accessible, one at a time, through the small hole in the cabinet just above the channel selector shaft.

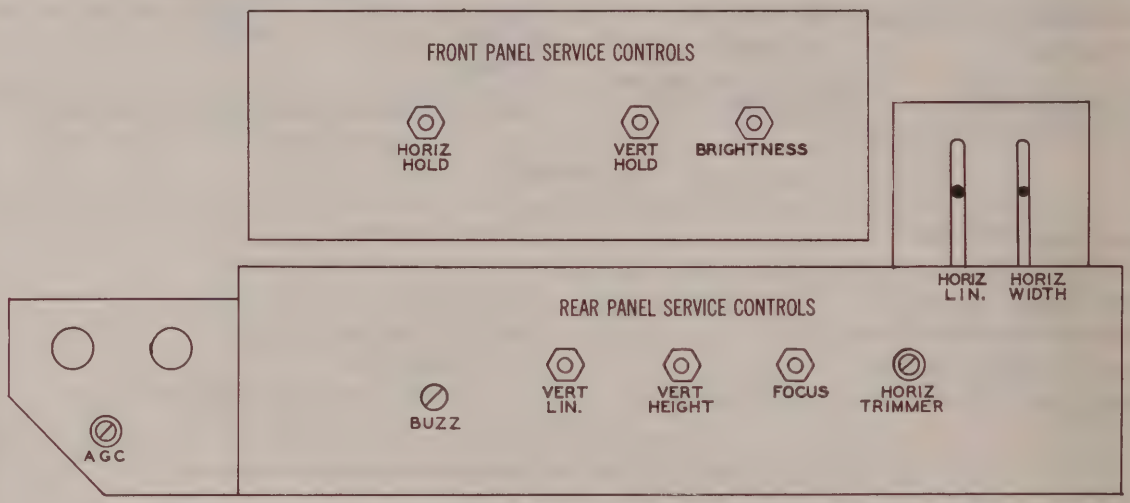
PICTURE TUBE SAFETY GLASS CLEANING

For picture tube safety Glass cleaning, it is necessary to remove chassis. (See disassembly instructions.)

PICTURE TUBE REMOVAL

For picture tube removal it is necessary to remove chassis. (See disassembly instructions.)

SERVICE ADJUSTMENT LOCATION



HORIZONTAL OSCILLATOR FIELD ADJUSTMENT

For adjustment of the Horiz. Oscillator, it is necessary to remove the rear cover and supply power to set. Adjustment is located on top of chassis. Set the Horiz. Hold Control at the center of its range and adjust the Horiz. Osc. slug (L27) until, picture synchronizes horizontally. (For location see tube placement chart.)

SOUND IF DETECTOR BUZZ ADJUSTMENT

Buzz control is located on rear apron of chassis. If necessary, adjust slightly for minimum noise in receiver output. If results are unsatisfactory, see sound IF alignment using TV signal on Page 6.

FUSES

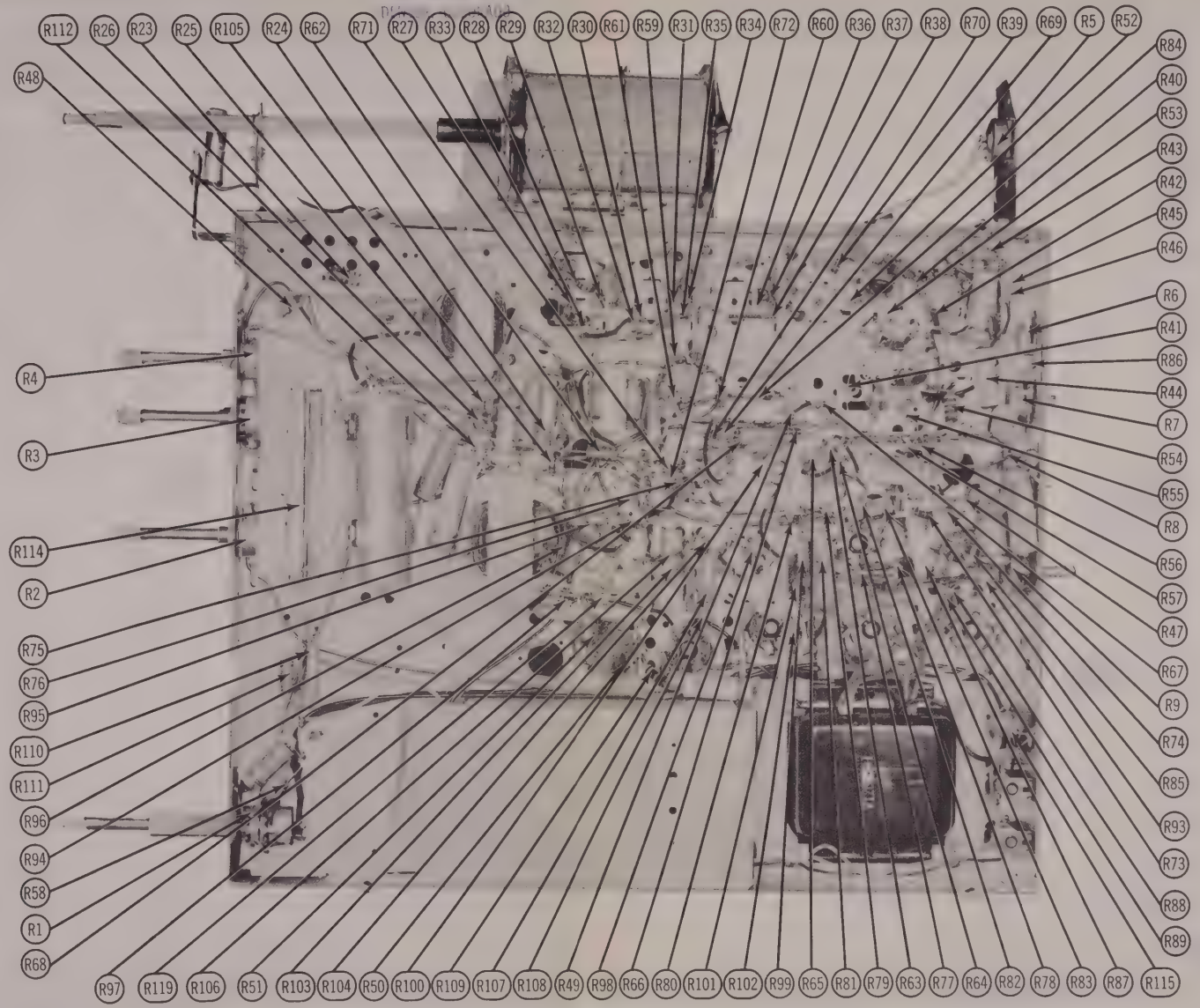
One fuse is used for Horiz. Sweep Circuit protection. For location see Tube Placement Chart.

CENTERING

Centering is accomplished mechanically by adjusting two magnetic rings around the neck of the picture tube, located flush against the deflection yoke. Rotate the two rings around the neck of the tube until the picture is properly centered.

DISASSEMBLY INSTRUCTIONS

1. Remove 4 push on type control knobs from front panel.
2. Remove 12 metal screws from rear cover. Unplug antenna lead from rear cover. Remove cover.
3. Disconnect speaker.
4. Remove 2 speaker nuts. Remove speaker.
5. Remove 6 chassis bolts. Remove chassis.



CHASSIS BOTTOM VIEW-RESISTOR IDENTIFICATION

PROPERTY OF
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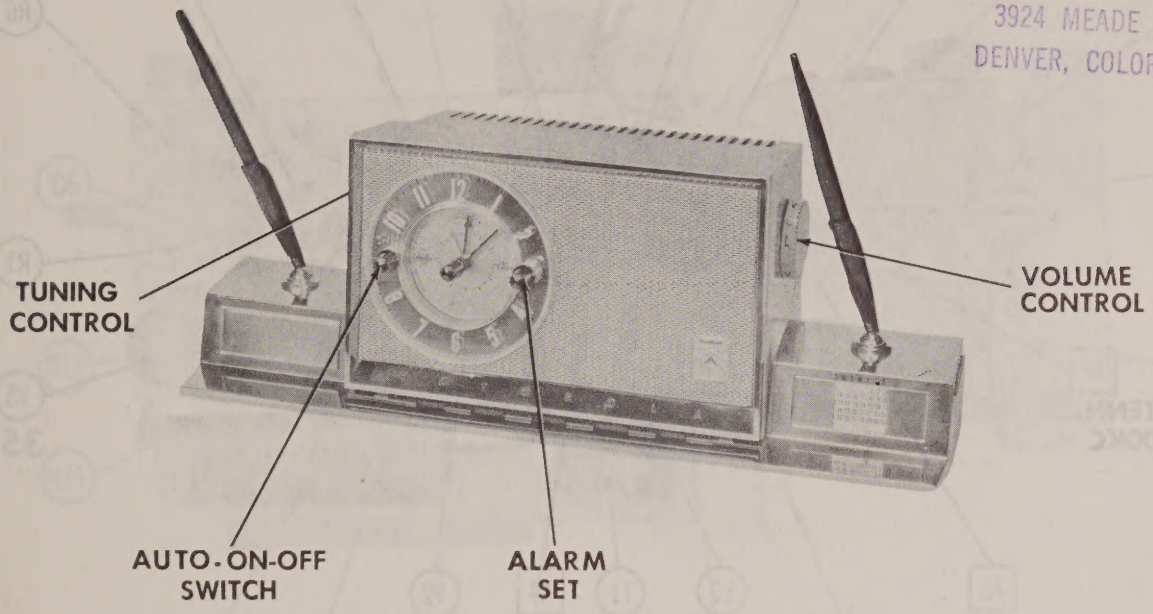
3924 MEADE ST.
DENVER, COLORADO

MOTOROLA
MODEL 53D1 (Ch. HS-359)



MOTOROLA
MODEL 53D1 (Ch. HS-359)

TRADE NAME	Motorola Model 53D1 (Ch. HS-359)
MANUFACTURER	Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.
TYPE SET	AC Operated AM Superheterodyne Receiver With Electric Clock
TUBES (Five)	Types 12BE6 Conv., 12BA6 IF Amp., 12AT6 Det.-AVC-AF Amp., 50C5 Audio Output, 35W4 Rectifier
POWER SUPPLY	110-120 Volts AC-60 Cycles RATING .23 Amp. @ 117 Volts AC
TUNING RANGE—BROADCAST	535-1620KC

ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

To set pointer, turn tuning capacitor fully closed and set pointer to last reference mark at low frequency end of dial.
Use isolation transformer, if available. If not, connect a .1MFD capacitor in series with low side of signal generator and B-.
Loop should be maintained in same relative position to chassis as when receiver is in cabinet.
Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain an output reading. Use an insulated alignment screwdriver for adjusting.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1.	.1MFD	High side to pin 7 (grid) of 12BE6 (V1). Low side to B-.	455KC (400~Mod)	Tuning gang fully open	Across voice coil	A1, A2, A3, A4	Adjust for maximum output. If isolation transformer is not used, reduce dummy antenna to .001MFD to reduce hum modulation.
2.	"	"	1620KC	"	"	A5	"
3.		Loop	1400KC	Tune to 1400KC signal	"	A6	Fashion loop of several turns of wire and radiate signal into loop of receiver. Adjust for maximum output.

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PARTS LIST AND DESCRIPTIONS

MOTOROLA
MODEL 53D1 (Ch. HS-359)

TUBES (SYLVANIA, GENERAL ELECTRIC, WESTINGHOUSE)

ITEM No.	USE	REPLACEMENT DATA		RETMA BASE TYPE	NOTES
		MOTOROLA PART No.	STANDARD REPLACEMENT		
V1	Converter	12BE6	12BE6	7CH	
V2	IF Amplifier	12BA6	12BA6	7BK	
V3	Det-AVC-AF Amp.	12AT6	12AT6	7BT	
V4	Output	50C5	50C5	7CV	
V5	Rectifier	35W4	35W4	5BQ	

CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA							NOTES
	CAP.	VOLT	MOTOROLA PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	ERIE PART No.	MALLORY PART No.	SPRAGUE PART No.	
C1A	50	150	23B630935	PRS150/50-30-10		BBRT5315C		2N520 TC22	TVA-3430	Red Green Yellow
B	30	150								
C	10	10								
C2	.05	200	8R9821	P288-0 5	DF-503	PJ2S5		PT415	2TM-S5	
C3	470		21R115856	SI470	D6-471	TP46	GP1K-471	UC-5347	5GA-T47	
C4A	220				D6-221	TP39	GP1K-221	UC-5322		
B	2000		♦21B482847	♦PA-100-1	DD-202	K072	801-002	DC-522	♦34C3	
C	220				D6-221	TP39	GP1K-221	UC-5322		
D	5000				DD-502	K080	801-005	DC-525		
C5	.005	600	8R9869	P688-005	D6-502	CUB6D5	GP2-333-502	PT625	6TM-D5	
C6	.01	400	8R9809	P488-01	D6-103	CUB4S1	GP2-333-103	PT411	4TM-S1	
C7	.047	400	8K490232	489ZX-047	DF-503	PJ4S47		PT4147	4TM-S47	
C8	.15	200	8K72686	P288-15		PJ2P15		PT4015	2TM-P15	

♦ Items C4A, C4B, C4C and C4D are combined in one unit.

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	MOTOROLA PART No.	IRC PART No.	CLAROSTAT PART No.	CENTRALAB PART No.	MALLORY PART No.	
R1A	1 Meg	½	18A630704	Q13-137X	A47F-1 Meg	BT-73	UT-438	Volume tapped @ 300K
B	Shaft		Not Req.	Not Req.	FS-3	Not Req.	Not Req.	Attach to R1A

RESISTORS

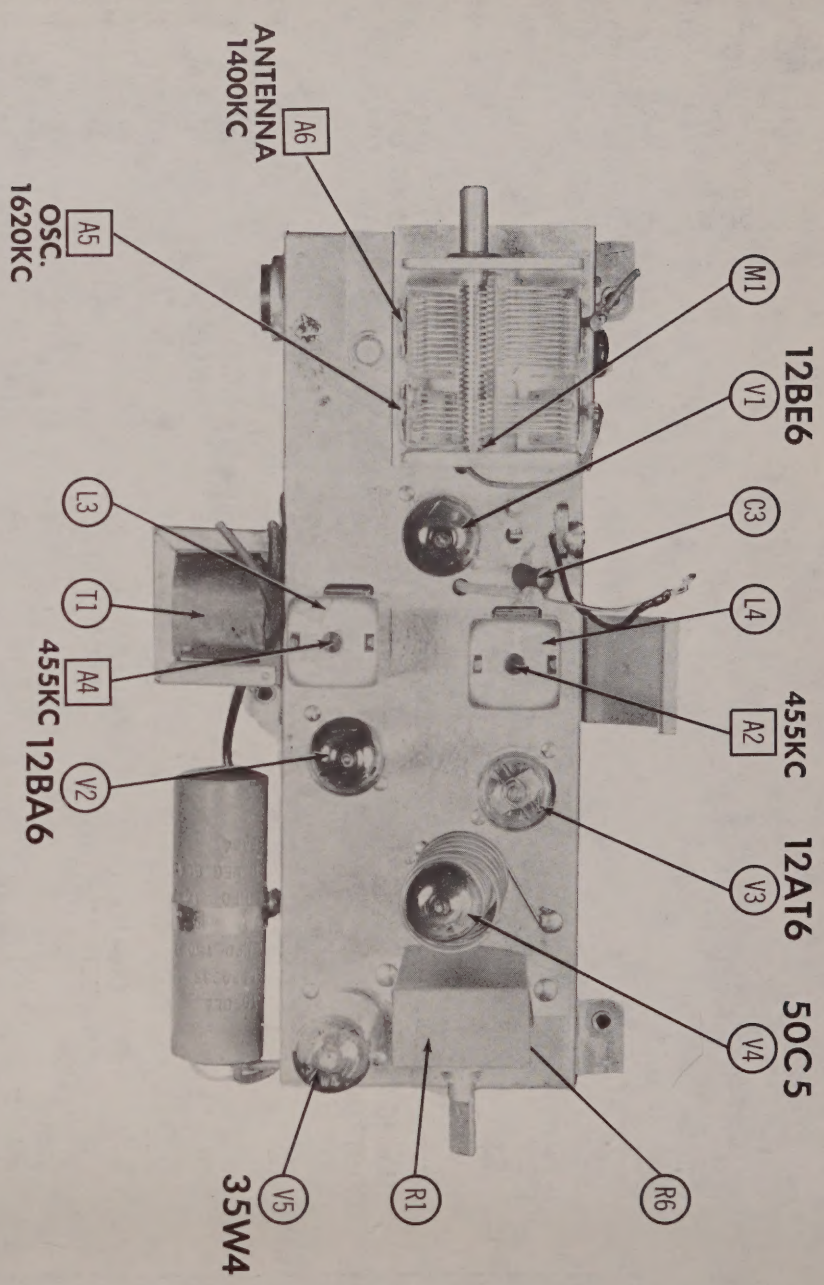
ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R2	1 Meg	½	6R6004	BTS-1 Meg	
R3	22KΩ	½	6R6028	BTS-22K	
R4	150Ω	½	6R6373	BTS-150	
R5	2.2Meg	½	6R3927	BTS-2.2Meg	
R6	33KΩ	½	6R6410	BTS-33K	
R7	10 Meg	½	6R2109	BTS-10 Meg	

ITEM No.	RATING		REPLACEMENT DATA		NOTES
	OHMS	WATT	MOTOROLA PART No.	IRC PART No.	
R8	220KΩ	½	6R6015	BTS-220K	
R9	470KΩ	½	6R6032	BTS-470K	
R10	150Ω	½	6R6373	BTS-150	
R11	1000Ω	1	6R3953	BTA-1000	
R12	27Ω	½	6R5683	BTS-27	

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA						NOTES
	PRI.	SEC.	MOTOROLA PART No.	Stancor PART No.	Merit PART No.	Triad PART No.	Halldorson PART No.	Thordarson PART No.	
T1	2.4KΩ	3.1Ω	25B-630936-0	A-3332	A-3025	S-12X	Z1101		

CHASSIS—TOP VIEW



PARTS LIST AND DESCRIPTIONS (Continued)

SPEAKER

ITEM No.	RATINGS			REPLACEMENT DATA			NOTES
	SIZE	FIELD	V. C. IMP.	MOTOROLA PART No.	JENSEN PART No.	QUAM PART No.	
SP1	4"	PM	3.1Ω	50C630981	ST-113 Mod. P4-X	4A1	

COILS (RF-IF)

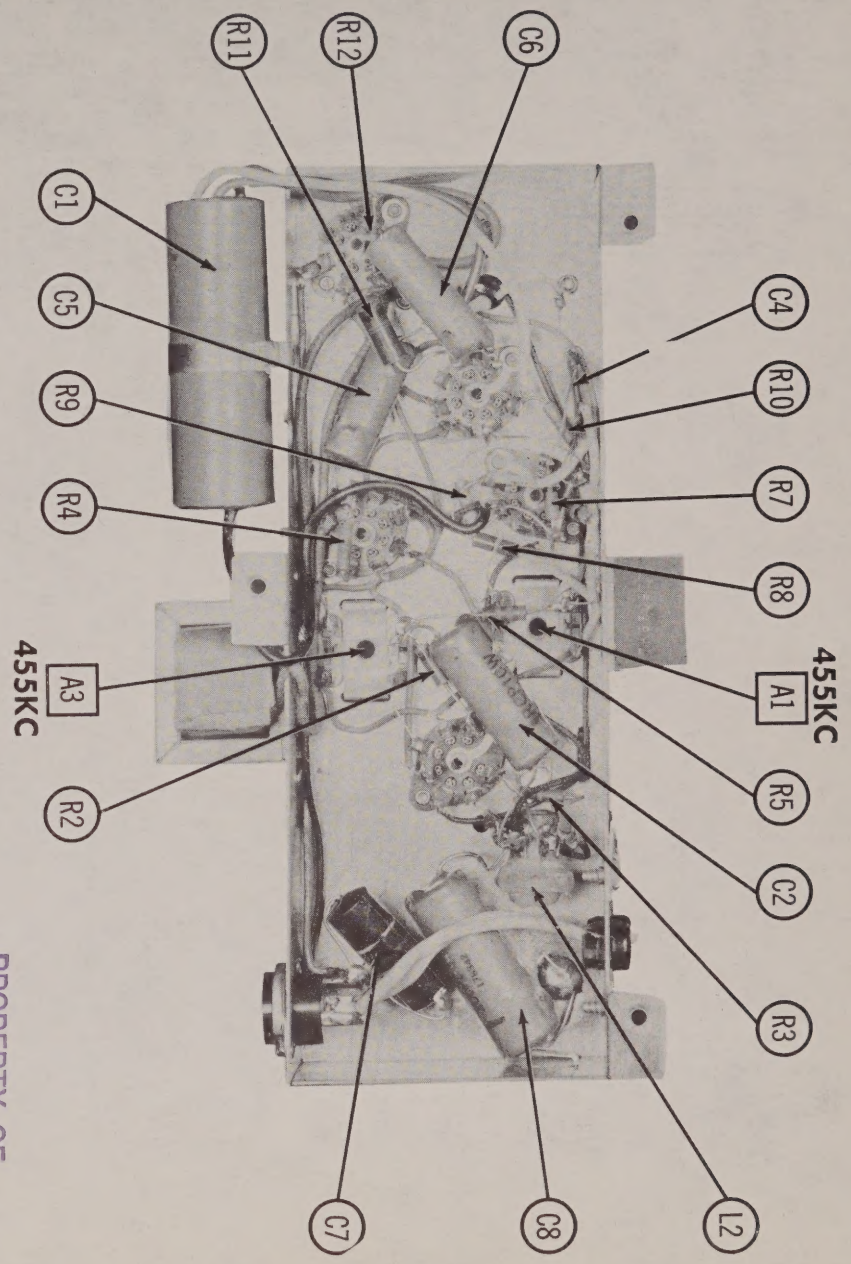
ITEM No.	USE	DC RES.		REPLACEMENT DATA				NOTES
		PRI.	SEC.	MOTOROLA PART No.	MEISSNER PART No.	MERIT PART No.	MILLER PART No.	
L1	Loop Ant.	3.2Ω		24C630947				Includes panel assembly
L2	Osc. Coil	1.1Ω	11Ω	24B610838	14-1073		69-Osc. †	
L3	Input IF	17Ω	17Ω	24C485553	16-6758	BC-352	12-C1	
L4	Output IF	17Ω	17Ω	24C485553	16-6758	BC-353	12-C2	

5 † Drill mounting hole.

MISCELLANEOUS

ITEM No.	PART NAME	MOTOROLA PART No.	NOTES
M1	Tuning cap	19K630939	(18-352MMF, 14-103MMF)
M2	Clock	72D630886	
	Knob	36B630991	Clock controls
	Knob	36A630989	Time set
	Knob	36C630987	Tuning
	Knob	36K630988	Volume

CHASSIS—BOTTOM VIEW



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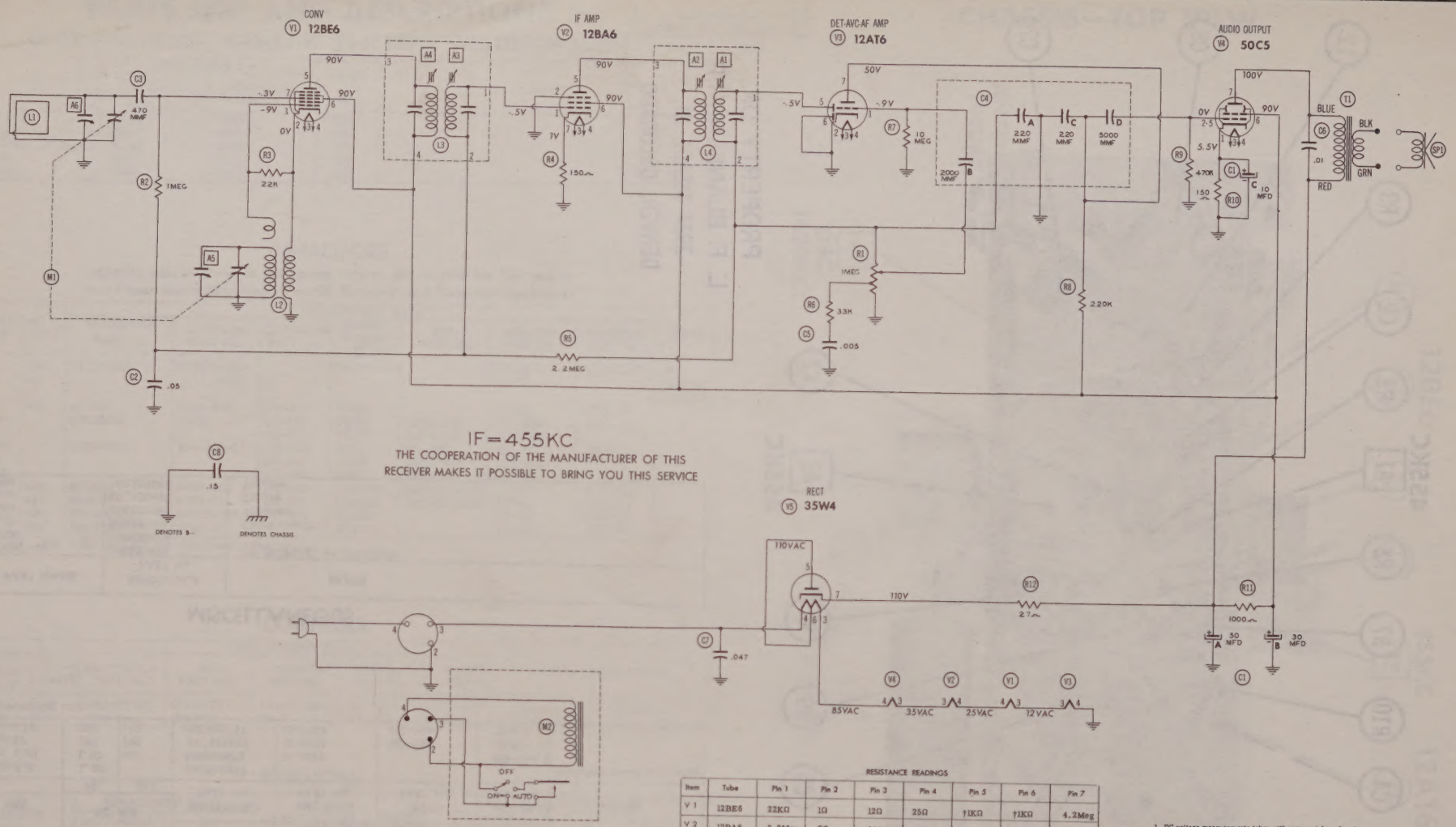
3924 MEADE ST.
DENVER, COLORADO

MOTOROLA
MODEL 53D1 (Ch. HS-359)



RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V 1	12BE6	22KΩ	1Ω	12Ω	25Ω	†1KΩ	†1KΩ	4.2Meg
V 2	12BA6	3.2Meg	0Ω	37Ω	25Ω	†1KΩ	†1KΩ	150Ω
V 3	12AT6	10Meg	0Ω	12Ω	0Ω	1Meg	0Ω	†220KΩ
V 4	50C5	150Ω	470KΩ	37Ω	90Ω	470KΩ	†1KΩ	†180Ω
V 5	35W4	†27Ω	†27Ω	90Ω	128Ω	120Ω	120Ω	200KΩ

† MEASURED FROM PIN 7 OF V5

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance on component values makes possible a variation of ± 15% in voltage and resistance readings.
6. Volume control at maximum, no signal applied for voltage measurements.

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